Farmers' Goals and Efficiency in the Production of Sugar Cane: The Philippine Case

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Farmers' Goals and Efficiency in the Production of Sugar: The Philippine Case

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M. Dina Padilla-Fernandez and Peter L. Nuthall *

Abstract

This research evaluated the link between Philippine Sugar cane farmers' goals, values and attitudes (and some selected efficiency-related variables) with production efficiency.

The analysis was based on both information from informal interviews and formal primary data collection. The Data Envelopment Analysis technique was used to determine the relative efficiencies of individual farmers and to identify the major factors that influence the efficiency of production. Pure technical, scale, overall technical, allocative and economic efficiency measures were derived for the sample of sugar cane farmers from the Central Negros area, The Philippines. Under the specification of variable returns to scale (VRS), the mean pure technical, scale, overall technical, allocative and economic efficiency indices were 0.7580, 0.9884, 0.7298, 0.7941 and 0.6025, respectively.

The farmers' characteristics and their associations with goals and attitudes were determined. The result shows that 'per cent of land owned' is correlated with farmers' decision-making and thus their production efficiency.

The study was unique in that it incorporated the farmers' values and attitudes towards farming and production efficiency. The Bootstrap regression method was used to determine the factors affecting the variations in farmers' efficiency. Factors positively associated with production efficiency include farm experience, exposure to extension and off-farm work; for goals and attitudes - the intrinsic independence goal, the instrumental aspects of farming, leisure orientation, optimistic attitude, and risk consciousness were all associated with efficiency.

The key policy options that must be considered for addressing inefficiencies include education and extension advice, developing the importance of the instrumental aspects of farming, developing group (block) farming as well as farmers' and millers' cooperatives, improved access to credit and improved technology (with emphasis on soil and fertiliser management and the use of improved varieties).

Key words*: Data Envelopment Analysis, technical efficiency, scale efficiency, allocative efficiency, economic efficiency, frontier efficiency analysis, farmer's goals, sugar cane farmers, Philippines.*

1 Introduction

A very important aspect of farm management is the setting of goals and objectives. Goals are commonly referred to as objectives or aspirations for which a person has decided to strive. (Öhlmér *et al.*, 1998).

Basically, a person's choice of goals is influenced by his/her values and beliefs (Gasson, 1973). Values refer to a person's view of the goodness of objects, results, and situations. They also express one's needs and motives; goals and objectives express the means to follow those values (Öhlmér *et al.*, 1998). Beliefs describe what people think is reality. A belief involves mental conviction, acceptance, confidence, or faith that a proposition is true. Beliefs influence values. Values also influence beliefs (Gasson, 1973).

In farming, economic goals such as profit or output maximisation may be the farmers' primary goal, however non-economic goals are also important. This is usually the case on family farms when the unit of production is both family and business enterprise-based. This

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dual economic farming activity within the household causes a unique form of decision making as choosing a particular farm goal may preclude the choice of a family goal or *vice versa.* Fundamental decisions have to be made, say, in the allocation of family members' time between competing activities- production and 'reproduction' in the farm business, off-farm work and leisure.

Goals give purpose and direction to decisions and performance, therefore they must be defined and serve as a measure of farm success or failure (Osburn and Schneeberger, 1983). These factors have implications for farmers' efficiency analysis (Ellis, 1988).

Efficiency is an important characteristic in judging the performance of farmers. Production efficiency is the ability of the farmers to produce an output at minimum cost (Kopp, 1981) and to combine outputs for maximum profit. It may be divided into technical and allocative efficiency. Farmers are technically efficient if they produce the maximum obtainable level of output from given inputs and technology. Farmers are allocatively efficient if their production inputs and output combinations give maximum profit for given resources. That is, farmers are allocatively inefficient due to their sub-optimal combination of inputs (Farrell, 1957, in Torkamani and Hardaker, 1996 p.76) and/or due to their inefficient combination of outputs.

Efficiency studies can determine if farmers could possibly raise productivity. If the farmers are not producing efficiently, their production can be increased through improved management practices by transferring the experiences of the efficient farmers to the less efficient ones. If the farmers are operating efficiently, their production can be increased through the adoption of new technology (Abate, 1995), when available.

However, some farmers may be reluctant to move out of the less productive technology. This kind of attitude[1] towards new practices may develop from the value that the farmers place upon farming. If they value farming in its current form as a way of life, they may accept relatively quickly those practices they perceive as conserving their own time and physical effort, and possibly resist practices they perceive as involving pressure to reorganise their farm business, and change their way of life.

Therefore, differences in personal, family and farm business goals may be considered in determining the factors as to why one farmer is more economically efficient than the other one. It can be argued that in the decision-making process of a farmer, a combination of economic, sociological and psychological considerations are all factors. Thus, research on farm efficiency may be more substantive if it can be seen from these perspectives rather than from the simple assumption of a single profit directed objective.

2 Historical Background of the Philippine Sugar Industry

The values and beliefs of the sugar cane farmers,[2] and how these attributes have interacted with the situations in the industry are also important factors that may have influenced the farming systems and therefore production efficiency. Therefore, any attempt to improve efficiency in the industry must allow for all these factors which are reviewed below.

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[1] 'Attitudes are orientations toward or away from some objects, concepts, or situations, and a readiness to respond in a predetermined manner to these or related objects, concepts, or situations. The formation of attitudes may be attributed to such factors as culture, the home and family within a culture, and the individual's social interactions with formal and informal groups. Attitudes are, in part, determined by the culture in which the individual is reared' (Andres, 1981 p.104). Many different beliefs and values may underpin an attitude. This may be the cause of farmers' reluctance to move out of the less productive technology.

[2] Or the industry - accepted title- planters or *hacenderos* who are generally the owners of the land [Aguilar, 1984]. Today, *hacenderos* can be lessees who pay rent in cash or equivalent to 18 to 20 per cent of the sugar produced.

During the Spanish regime, the colonial government encouraged the people to produce sugar by offering incentives *e.g.*, easy credit, milling equipment and access to untitled lands. At the farm level, the *hacenderos* provided, in varying degrees, credit, animals, equipment, houses, medical fees, clothing and money for social obligations to labourers to ensure and control them to stay on the farms. Thus the paternalistic management styles in the sugar industry developed.

The rise of sugar as an export crop attracted many foreigners and merchants into sugar cane farming. Foreigners and merchants became the new breed of planters, some of the pioneers in sugar farming became sharecroppers and others who lost their land to the new breed of planters became the *hacienda* (farms) labour forces. This had led to the development of the different management styles. As Billig (1994 p.664) noted, 'the proliferation of these people with different socio-economic and cultural backgrounds had generated the 'hustlers, profiteers and entrepreneurs' in the sugar industry'.

During the American rule, the centrifugal mills were installed and the farms were grouped into mill districts. Consequently, a production quota system was imposed for each mill district. This arrangement organised the industry in a highly non-competitive way. Since sugar was transported entirely by rail, a planter could not choose to send the cane to a different mill (Quirino, 1974 in Billig, 1993). This impacted the entrepreneurial skills of the farmers as they had no incentive to increase and/or improve their production.

Meanwhile, the modernisation process changed the agrarian structure in the industry as consolidation of more wealth and power within the industry occurred. These factors contributed to the planters' banding together into a 'sugar bloc' that gave them influence and protection, including politically.

During the Post-war years the insurgency in the countryside grew and this started the 'landlord absentee' type of management that generally caused production inefficiencies. The change in residence by the planters minimised the supervision on the farms and also aggravated the weak relations among the sharecroppers and farm labourers which lessened the quality of the performance of the farms. This absentee landlordism doubled during the 1984 international sugar crisis as leftist insurgents grew increasingly bold in the countryside.

Over the 1950s, 60s and 70s, the dependency of the Philippines on the Americans deepened as the country was granted a high U.S. sugar quota until 1974. During these years, sugar producers enjoyed an improved lifestyle. However, had they invested money in their farms and mills, instead of relying on the sure U.S. market and protection from the government, they may not have felt the effect of the sugar crises from 1978 till the mid-1980s, and they may not have opposed the GATT policy.

In 1974, Martial Law was imposed and placed the sugar industry under government monopoly. The planters had their political powers reduced although a few became more influential because of their political connections. Later, sugar was changed to a free-trade enterprise and this should have been the incentive to increase production efficiency. However, as the industry became more exposed to the domestic and international competition, planters became more vulnerable. Some left the business.

Many problems beset the industry and these affected the performance of the farmers as well as the people in the different sectors of the industry. The Comprehensive Agrarian Reform Program (CARP) is one policy that lessens the incentive to invest in the sugar industry and to pursue productivity gains. The CARP lowers the collateral value of agricultural land and this further reduces the flow of credit to agriculture. The fragmentation of land into small farm sizes countervails efficiency in farm production.

Currently a re-distribution of sugar land is occurring due to the full implementation of the CARP. The changed agrarian structure and the implication of the paternalism resulted in a large gap between big and small sugar cane farmers' performance. The big planters blamed the low production and productivity on the inefficiency of small planters. Considering big planters own and control around 71 per cent of the country's total sugar land means much of the cause lies with them. As big planters have access to information, modern technology and extension services, they should produce efficiently. Small farmers, on the other hand, with sub-marginal land areas, might be expected to produce sub-optimally. But as sugar cane is all they are familiar with, to them sugar is profitable as it entails far less risk compared to other crops. Moreover, it is a crop that does not require intensive care.

There are still some large sugar *haciendas* in the Philippines, but the trend now is toward smaller holdings. Apart from the CARP, one of the reasons is the 'natural land reform,' which is how landowners refer to the process of partitioning through inheritance, and because of this, different types of farmers and farm management styles exist. Billig (1993) described the sugar cane planters of today in this manner:

> 'There are still many sugar planters in the Philippines who are knowledgeable and dedicated agriculturalists. These planters spend time on their farms, know the workers personally, and are involved in day-to-day management. Such *haciendas* tend to be the most productive and humane ones. But there are also many planters, perhaps the majority, who know little about agriculture. These are typically the ones who spend little time on the farm, delegate all responsibility to *encargados*, have no personal relationship with the workers, and concern themselves only with the expenditure and income of the farm. Some of these are educated professionals who inherited haciendas but prefer to devote their attention to their careers. Others simply do not like farming and prefer golfing, socialising and travelling - all supported by profits from the *hacienda*. They are planters because they inherited land rather than because of any interest, competence or labour of their own' (p.131).

3 Background of the Problem

Arguments against increasing the number of farms of reduced size units through the Comprehensive Agrarian Reform Program (CARP)[3] in the Philippines are based on the premise of economies of farm size and the prevention of investments in the commercial crop sector thus disrupting production of cane. It is argued that large farms perform better because there is the opportunity for the optimal utilisation of resources. The use of modern machines like tractors and harvesters is considered to be more appropriate and economically efficient given large farms. It is also argued that land reform may lead to the beneficiaries using a large percentage of the earnings for consumption rather than investments. Such a reduction in investment ultimately leads to a decline in production with a further negative effect on revenue (Putzel and Cunnington, 1989).

Perhaps the most legitimate argument of the landed class relates to the management skills and attitudes of the land reform beneficiaries. As Putzel and Cunnington (1989 p.25) described, 'tenant/farm workers in any case do not have the skill and wherewithal required for cash crop production.' They are intrinsically lazy and should not, therefore, be entrusted to own land of their own (Hayami *et al.*, 1990).

Eduardo Locsin, who implemented land reform in his own hacienda (plantation), also believed the major cause of failure of his experiment was the mentality and management styles of the people (McBeth, Far Eastern Economic Review, 25 January 1990). Ledesma and Montinola (1988 p.38) expressed this sentiment succinctly: '... there is one hindrance to

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[3] The CARP was aimed at establishing owner cultivatorship of economically sized farms that would ultimately improve productivity and provide equity among the farmers, tenants and farm workers.

an effective land reform programme, it is the persistence of the dependency mentality among the potential beneficiaries ... they do not have the initiative to look for their own solutions to their problems and difficulties.'

It can be inferred that the fixed social arrangements developed in the *hacienda* by the landlords centuries ago (when labour had the bargaining power and the sugar industry had a favourable world market) had caused the shadow of paternalism and dependency in the lives of the farming people. These formed the farmers' framework of values and these also negatively influence their farming performance.

Locsin gave a more positive comment: 'It all comes down to a fear of the unknown and an ingrained lack of self-confidence.' He added: 'the worker was reduced to an automaton. He can only think in terms of 24 hours. He doesn't budget because he can always ask for an advance.' He added: 'they don't know how to own anything because the hacienda always did it for them. They would even come to my wife and ask her how they should name their babies' (McBeth, Far Eastern Economic Review, 25 January 1990 p. 26).

This also confirms the findings of Ledesma and Montinola (1988). The first year of the land reform programme did not show positive changes and its beneficiaries said they preferred having a landlord.

In 1997, a Presidential Task Force was created to determine the cause of low sugar production. The Committee noted the large number of small farmers (84 per cent) and their performance. Small farmers have a lower yield (46.45 tonnes cane per hectare as against 61.37 for large farmers) and in terms of total cane production, only 25 per cent comes from them. The Committee reported that the fragmentation of farms had resulted in inefficient and many uneconomic farm sizes and further noted that some aspects of economies of scale in sugar cane farming are difficult to overcome. For larger farms the Committee also reported that CARP had decreased farm investments due to uncertainties in land ownership and valuation (Report of the Presidential Task Force on the Sugar Industry, Sugar Regulatory Administration, 1997).

The performance of the small *vis-à-vis* large farms and the trend towards increasing the number of the small farms due to the full implementation of the CARP have important implications in the production of sugar. The current economic reform of moving towards a free world market economy (*e.g.*, GATT and AFTA) would make sugar cane farmers uncompetitive if exposed to world market prices. The Philippine sugar production cost of US-28.60 cents a kilogram is unprofitable, as the world sugar price is 29.04 US-cents a kilogram. The 19.8 to 22 US-cents per kilogram production costs of Australia, Brazil and Thailand (Sugar Letter, Sugar Y Azucar, 1996) means it would be cheaper to import all supplies, but the balance of payments would be affected.

The Philippines has 18 sugar-producing provinces, 36 (out of 41) operational mills and 16 refineries. Around 556,000 workers are employed directly on the farms and around 25,000 in the processing plants. About 5 million people are dependent on sugar for their economic existence. There are around 348,000 hectares of sugar cane land and approximately 37,000 sugar cane farmers. (Report of the Presidential Task Force on the Sugar Industry, Sugar Regulatory Administration, 1997).

In view of the vital contribution and role of the industry to the Philippine economy, the production of sugar must be given proper support by the government if it is to be made economic and for the farmers to improve their efficiency markedly. The problem is to decide whether these farmers can operate at a level of economic efficiency that will ensure their future survival. Agricultural policy makers must consider whether support and restructuring will achieve these ends.

Knowledge of the productive efficiency of sugar cane farms will indicate whether agricultural production under the present conditions can be increased without the use of high investment capital. This study investigates whether farmers are efficient in their resource utilisation, whether their decision behaviour is rational in an economic sense, and the significance of non-economic goals as well as their associations.

A knowledge of farmers' goals, values and attitudes, say in the maintenance of traditions, or valuing leisure more than work, are necessary in understanding the efficiency variations. In this study, the farmers' goals, values and attitudes are determined and along with the socio-economic variables, they are related to farmers' efficiency levels to identify relationships that have implications on farmers' productive efficiency. This will allow a more effective sugar industry policy to be formulated.

4 Conceptual Framework

Osburn and Schneeberger (1983 p.7) believed that 'it is in this managerial gap' which distinguishes why some agricultural businesses have grown and prospered, while other similar ones have failed and gone out of the business.'

Physical resources are not productive unless they are organised and co-ordinated effectively. The management may be provided by a single individual- the farmer, or by a hierarchy of decision-makers in a corporate farm. 'How that decision-maker will react in a given situation, basically how he/she thinks, can be viewed as a psychological question in an economics context' (Howard, 1997 p.39).

One instrument that has been used to distinguish a number of psychological characteristics of farmer's is their value system[4] (or orientations). Gasson (1973) developed these orientations from Cambridgeshire and Suffolk farmers by examining the goals and values that the sample farmers held. An instrumental orientation implies that farming is viewed as a means of obtaining income and security with pleasant working conditions. Farmers with a predominantly social orientation are farming for the sake of interpersonal relationships in work. Expressive values suggest that farming is a means of self-expression or personal fulfilment while an intrinsic orientation value means that farming is valued as an activity in its own right.

Many characteristics may be associated with value orientations. A case could be made for including human capital investment (*e.g.*, education, farming experience, association with a particular farm, attendance in seminars/training) and socio-economic characteristics (*e.g.*, age, family size, off-farm work, type and size of farm, income level and indebtedness and so on) [Gasson, 1973].

Pemberton and Craddock (1979 p.23) found in the Carman region of Manitoba in Canada that 'high income farmers are more oriented to economic and monetary goals and have higher levels of aspiration than the lower income farmers', who seem to be more oriented to economic survival. Scales (1990) also found that top New Zealand farmers emphasised maximum profit as important for success, while average income farmers emphasised getting

[4] Goals and values can predict human behaviour by determining where they stand relative to one another. They are organised in systems or value orientation. Variation in the rank order of common value components, all of which may be present, cause value systems (or orientations) to differ between individuals and between sub-groups of society. That is, people desire to achieve all valued ends but in situations where these are mutually exclusive, it is the relative ordering of values which determines how they decide to act or perform (Gasson, 1973). A value system, therefore, is a method that people use to solve their problems, and cope with their environment (Andres, 1981).

an average standard of living. Not all farmers aspire to be top producers (Fairweather and Keating, 1990).

Perkin and Rehman (1994) correlated the 'monetary', 'lifestyle' and 'independence' goal components with the socio-economic status of British farmers and the main findings were: (1) age and education were related to 'lifestyle', (older people are more likely to want to remain on the farm and less likely to want time away to do other things. The converse is true for those respondents who have received formal higher education at a college of agriculture or university); and (2) long-term debt was related to 'independence', particularly the purchase of land, that is, the 'ownership of property.' The lifestyle component exerts an influence over the level of intermediate debt.

Therefore, farmers' human capital investment and socio-economic characteristics may be hypothesised to be related with farmers' value and attitude orientations, and thus, may also influence farmers' management or decision-making skills.

Some researchers *e.g.,* Salamon (1985) and Salamon and Davis-Brown (1986), Ploeg (1985), Fairweather (1987), Olsson (1988) and Pomeroy (1987) used these value orientations to determine the psychological characteristics of the farmers that are most likely to survive an economic downturn (Table 1). The asterisks beside the management styles listed in Table 1 are those thought to be most likely to survive an economic downturn. Olsson and Pomeroy both see the entrepreneur as best suited to adapt to changes in primary production, and Salamon and Davis-Brown believe that cautious production best suits an economic downturn. However, Ploeg notes that each style can be economically successful while Fairweather leaves open the issue of which strategy is best for survival and notes that there is no consensus on which management style best equips a farmer to survive an economic downturn (Fairweather, 1987). Thus, the literature is not particularly helpful.

Table 1. Different management styles.

Management Styles		Source	Country
Entrepreneur	Yeoman *	Salamon, 1985 Salamon & Davis-Brown, 1986	US
Extensifier *	Intensifier *	Ploeg, 1985	Italy
Financial Manager Productivity Increaser	Individualist Worker Lifestyler	Fairweather, 1987	New Zealand
Entrepreneur*	Cautious Strategist	Olsson, 1988	Sweden
Accumulator *	Sufficer	Pomeroy, 1987	New Zealand

* Farmers considered most likely to survive an economic downturn.

Source: Fairweather and Keating (1990)

However, little is known about the efficiency of the farmers under each management style. Some studies equate efficiency with survival and describe who is best equipped to survive in the long run.[5] Therefore this study tried to determine the efficiency of the farmers by measuring their production efficiency and relating this to their management style.

Production efficiency may also be associated with human capital, socio-economic characteristics, farm environment and the adoption of technology by the farmers. For example, technical inefficiency may be explained by factors such as the use of an obsolete production technique, or the inappropriate operation of a modern one. This may be due, for instance, to a lack of technical information or the poor organisation of production tasks.

[5] A farm, which survives and is able to make acceptable profits in a competitive world, is likely to be considered efficient in some sense. Profits are one measure of this. Another measure is the ability and willingness of the farm to make new or expand investment [Sheperd *et al.* (1983) Microeconomic Efficiency and Macroeconomic Performance, in Silberston (Ed.)].

Therefore, efficiency is expected to be related to variables such as the education and technical skills of the farmer, and possibly age (Hallam and Machado, 1996). A number of variables might at least explain part of the differences in efficiency between and among farms.

Battese *et al.* (1996) considered the age of the primary decision-maker, the maximum years of formal schooling for members of the household, and the ratio of adult males to the household size, as explanatory variables to the inefficiencies of production of wheat farmers in the four districts of Pakistan. They found that in one district, age and schooling of farmers are significantly related to the efficient production of wheat.

Factors like farm size, credit availability and extension contacts were also introduced to explain the causes of farm inefficiency (*e.g.,* Kalirajan and Flinn, 1983, Lingard, Castillo and Jayasuriya, 1983). Meanwhile, Parikh and Shah (1994) added the value of farm assets and the degree of land fragmentation to determine the variations of technical efficiency in the North-West Frontier Province of Pakistan. The analysis suggested that younger farmers with easier access to credit, more education and larger assets are most likely to operate efficiently. They further suggested that increased education and availability of credit along with land consolidation would lead to improvements in efficiency.

The relation between efficiency and farm size has received the most attention in the literature (*e.g.,* Britton and Hill, 1975; Pasour, 1981; Abate, 1995; Piesse, 1996; Adesina and Djato, 1996; and Tadesse and Krishnamoorthy, 1996). Yet, there is no consensus among the available studies on the age-old debate of efficiency differences in the small *vs* large-scale farm (Tadesse and Krishnamoorthy, 1996).

The conceptual paradigm proposed is presented in Figure 1. It is assumed that the independent variables on the left of the diagram exert a certain influence directly or indirectly on the criterion variable. Each arrow in the figure represents a presumed path of influence.

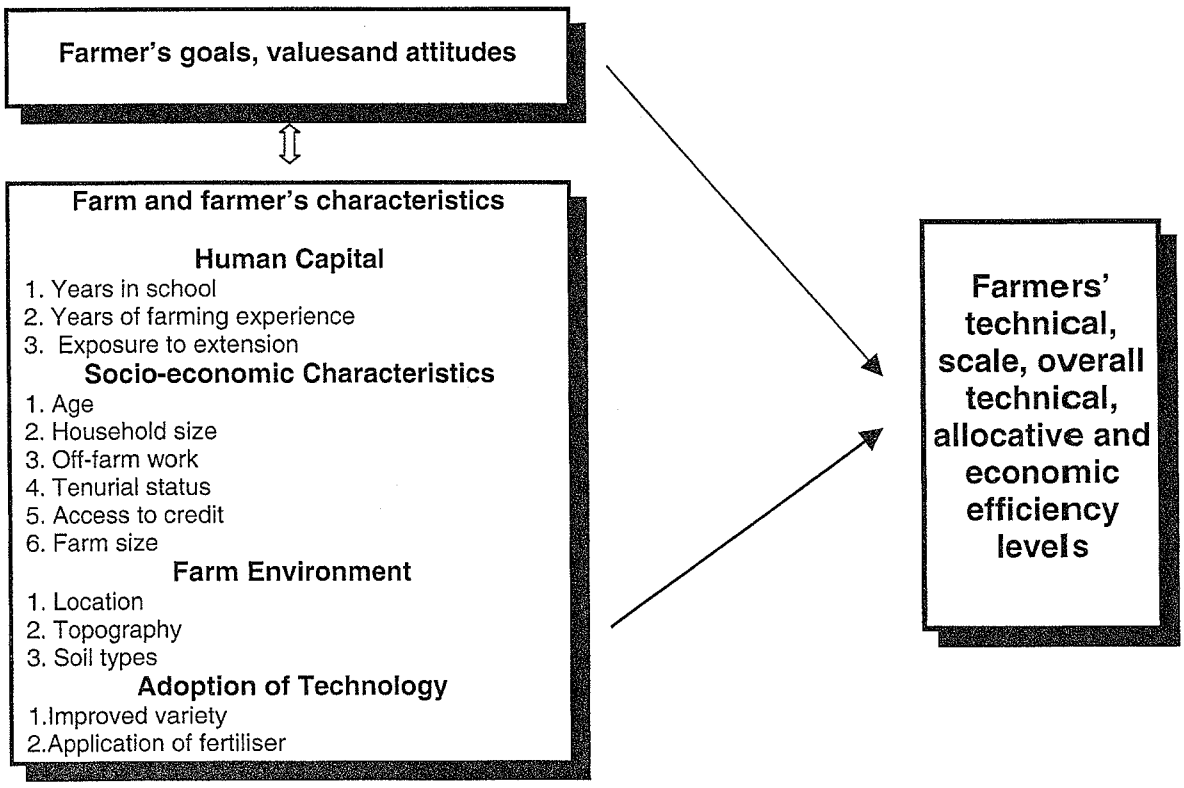

Figure 1. A schematic paradigm showing the associations of farmer's goals, values, attitudes, some selected-efficiency variables and farmer's production efficiency levels.

5 Analytical Framework

Data envelopment analysis (DEA), introduced by Charnes, Cooper and Rhodes (1978) and further formalised by Banker, Charnes and Cooper (1984) is a non-parametric approach that estimates 'production' technologies and thus measures efficiencies in production using the observed inputs and outputs of the sampled farms.

In this study, the individual technical and scale efficiency levels were derived and analysed using output-based DEA frontier analysis, while in the allocative efficiency measurement, the input-based DEA frontier was used. DEA models were estimated using the Warwick[6] Windows DEA program. The DEA linear programming models are specified below. Each linear programming problem is solved separately for each respondent in the database.

Under output maximisation and variable returns to scale (VRS) the software solves models A1.1 and A1.2 below.

Model A1.1

$$Min \quad Z = \sum_i y_{ij0} + \Omega_1 - \Omega_2$$

$$s.t. \quad \sum_r u_r y_{rj} - \sum_i v_i x_{ij} + \Omega_1 + \Omega_2 \leq 0$$

$$\sum_r u_r y_{rj0} = 1$$

$$u_r, v_i, \Omega_1, \Omega_2 \geq 0.$$

Where x_{ij} and y_{rj} are the i^{th} input and the r^{th} output level at DMU_j. J_0 is the DMU being assessed, the u_r are weights associated with the outputs, the v_i associated with the inputs, and are the unknowns to be solved for.

Let Z* be the optimal value of Z in the above model. The minimum and maximum limit of the Ω range are obtained by solving in turn the following two models:

Model A1.2

$$Min \ / \ Max \quad \Omega_1 - \Omega_2$$

$$s.t. \quad \sum_i v_i x_{ij0} + \Omega_1 - \Omega_2 = Z^*$$

$$\sum_r u_r y_{rj} - \sum_i v_i x_{ij} + \Omega_1 - \Omega_2 \leq 0$$

$$\sum_r u_r y_{rjo} = 1$$

$$u_r, v_i, \Omega_1, \Omega_2 \geq 0.$$

Notation is as in model A1.1

[6] Warwick Windows DEA User's Guide, 1996.

Under input minimisation and variable returns to scale the software solves models A2.1 and A2.2 below.

Model A2.1

$$Max \quad Z - \sum_r y_{rj0} + \Omega_1 - \Omega_2$$

$$s.t. \quad \sum_r u_r y_{rj} - \sum_i v_i x_{ij} + \Omega_1 + \Omega_2 \leq 0$$

$$\sum_i v_i x_{ij0} = 1$$

$$u_r, v_i, \Omega_1, \Omega_2 \geq 0.$$

Where x_{ij} and y_{rj} are the i^{th} input and the r^{th} output level at DMU_j. J_0 is the DMU being assessed.

Let Z* be the optimal value of Z in the above model. The minimum and maximum limit of the Ω range are obtained by solving in turn the following two models:

Model A2.2

$$Min \ / \ Max \quad \Omega_1 - \Omega_2$$

$$s.t. \quad \sum_r u_i y_{rj0} + \Omega_1 - \Omega_2 = Z^*$$

$$\sum_r u_r y_{rj} - \sum_i v_i x_{ij} + \Omega_1 - \Omega_2 \leq 0$$

$$\sum_i v_i x_{ijo} = 1$$

$$u_r, v_i, \Omega_1, \Omega_2 \geq 0.$$

Notation is as in model A2.1

The efficiency calculated from the VRS model is pure technical efficiency (PTE). Thus, PTE = 1 indicates that the farmer is in the frontier and is pure technically efficient and PTE < 1 indicates that the farmer is inefficient. Banker, Charnes and Cooper (1984) extended the original model [the Charnes, Cooper and Rhodes- CCR model or constant returns to scale (CRS) model [7]] to disentangle the effect of scale efficiency and showed that the CCR overall technical efficiency measure can be regarded as the product of the technical and scale efficiency measures (Banker and Thrall, 1992). Thus, scale efficiency is the ratio of the overall technical to the pure technical efficiency score.

Economic efficiency can be calculated as the product of the overall technical (CRS) and allocative efficiency (VRS).

[7] This can be calculated in the DEA software by selecting the CRS model.

6 The Bootstrap Multiple Regression Models

The Bootstrap method was used to overcome the dependency problem in the DEA efficiency scores (they are relative to each other – and thus dependent). The technique applied was with sampling replacement so that there was a probability that a certain unit would be sampled again (in this study the probability was 1/127). The efficiency scores for each bootstrap sample of size *n* was recalculated *i.e.,* the DEA model was re-run 100 times.

A bootstrap multiple regression technique was used to obtain the parameters of the models designed to account for the variations in the productive efficiency of the farmers. The models were specified on the basis of important considerations such as suspected collinearity among the independent variables, particularly the goal factors. Therefore, the total average score (*i.e.,* the item scores or the goals measured using the Likert scale), calculated from each goal and behaviour component, were introduced first along with the other explanatory variables (Model 1a). (See below for the variable definitions)

Model 1a $$\theta = a_0 + b_1\text{EDUC} + b_2\,\text{EXPE} + b_3\,\text{EXTN} + b_4\,\text{AGE} + b_5\text{HHSZE} + b_6\text{OFFWORK} + b_7\text{D}_{ow} + b_8\text{D}_{crdt} + b_9\text{D}_{bac} + b_{10}\text{FLAT} + b_{11}\text{SROL} + b_{12}\text{ROL} + b_{13}\text{CLAY} + b_{14}\text{SCLAY} + b_{15}\text{SANDY} + b_{16}\text{N} + b_{17}\text{P} + b_{18}\text{K} + b_{19}\text{D}_{HYV} + b_{20}\text{GOAL1} + b_{21}\text{GOAL2} + b_{22}\text{GOAL3} + b_{23}\text{GOAL4} + b_{24}\text{GOAL5} + b_{31}\text{ATTI1} + b_{32}\text{ATTI2} + b_{33}\text{ATTI3} + b_{34}\,\text{ATTI4} + b_{35}\,\text{ATTI5} + b_{36}\,\text{ATTI6} + u^*$$

In Model 1b, factor scores from a factor analysis (see ssection 9) were used instead of the item scores in explaining variations in farmers' efficiency. Thus,

Model 1b $$\theta = a_0 + b_1\text{EDUC} + b_2\,\text{EXPE} + b_3\,\text{EXTN} + b_4\,\text{AGE} + b_5\text{HHSZE} + b_6\text{OFFWORK} + b_7\text{D}_{ow} + b_8\text{D}_{crdt} + b_9\text{D}_{bac} + b_{10}\text{FLAT} + b_{11}\text{SROL} + b_{12}\text{ROL} + b_{13}\text{CLAY} + b_{14}\text{SCLAY} + b_{15}\text{SANDY} + b_{16}\text{N} + b_{17}\text{P} + b_{18}\text{K} + b_{19}\text{D}_{HYV} + b_{20}\text{GOAL1} + b_{21}\text{GOAL2fs} + b_{22}\text{GOAL3fs} + b_{23}\text{GOAL4fs} + b_{24}\text{GOAL5fs} + b_{31}\text{ATTI1fs} + b_{32}\text{ATTI2fs} + b_{33}\text{ATTI3fs} + b_{34}\,\text{ATTI4fs} + b_{35}\,\text{ATTI5fs} + b_{36}\,\text{ATTI6fs} + u^*$$

In Model 2a, the total average score (*i.e.,* the item scores or goals measured by ranking) calculated from each goal and behaviour component is included along with the other explanatory variables.

Model 2a $$\theta = a_0 + b_1\text{EDUC} + b_2\,\text{EXPE} + b_3\,\text{EXTN} + b_4\,\text{AGE} + b_5\text{HHSZE} + b_6\text{OFFWORK} + b_7\text{D}_{ow} + b_8\text{D}_{crdt} + b_9\text{D}_{bac} + b_{10}\text{FLAT} + b_{11}\text{SROL} + b_{12}\text{ROL} + b_{13}\text{CLAY} + b_{14}\text{SCLAY} + b_{15}\text{SANDY} + b_{16}\text{N} + b_{17}\text{P} + b_{18}\text{K} + b_{19}\text{D}_{HYV} + b_{25}\text{RGOAL1} + b_{26}\text{RGOAL2} + b_{27}\text{RGOAL3} + b_{28}\text{RGOAL4} + b_{29}\text{RGOAL5} + b_{30}\text{RGOAL6} + b_{31}\text{ATTI1} + b_{32}\text{ATTI2} + b_{33}\text{ATTI3} + b_{34}\,\text{ATTI4} + b_{35}\,\text{ATTI5} + b_{36}\,\text{ATTI6} + u^*$$

While in Model 2b, factor scores (see section 9) were used instead of the item scores (in goal ranking) in the estimation. Thus,

Model 2b $$\theta = a_0 + b_1\text{EDUC} + b_2\,\text{EXPE} + b_3\,\text{EXTN} + b_4\,\text{AGE} + b_5\text{HHSZE} + b_6\text{OFFWORK} + b_7\text{D}_{ow} + b_8\text{D}_{crdt} + b_9\text{D}_{bac} + b_{10}\text{FLAT} + b_{11}\text{SROL} + b_{12}\text{ROL} + b_{13}\text{CLAY} + b_{14}\text{SCLAY} + b_{15}\text{SANDY} + b_{16}\text{N} + b_{17}\text{P} + b_{18}\text{K} + b_{19}\text{D}_{HYV} + b_{25}\text{RGOAL1fs} + b_{26}\text{RGOAL2fs} + b_{27}\text{RGOAL3fs} + b_{28}\text{RGOAL4fs} + b_{29}\text{RGOAL5fs} + b_{30}\text{RGOAL6fs} + b_{31}\text{ATTI1fs} + b_{32}\text{ATTI2fs} + b_{33}\text{ATTI3fs} + b_{34}\,\text{ATTI4fs} + b_{35}\,\text{ATTI5fs} + b_{36}\,\text{ATTI6fs} + u$$

where θ = efficiency scores- technical, scale, overall technical, allocative and economic
a_0 = constant (θ intercept)
b_i = regression coefficients
EDUC = years in school
EXPE = years of farming experience
EXTN = number of exposures to extension (within 2 years)
AGE = respondent's age (years)
HHSZE = household size
OFFWORK= number of hours in off-farm work (per year)
D_{ow} = 1 if the respondent is a land owner, otherwise zero
D_{crdt} = 1 if the respondent has access to credit, otherwise zero
D_{bac} = 1 if the farm is near Bacolod City, otherwise zero
FLAT = fraction of an area with flat topography
SROL = fraction of an area with slightly rolling topography
ROL = fraction of an area with rolling topography
CLAY = fraction of an area with clay loam soil
SCLAY= fraction of an area with sandy clay loam soil
SANDY = fraction of an area with sandy loam soil
N = total amount of Nitrogen (kgs) applied per hectare
P = total amount of Phosphorus (kgs) applied per hectare
K = total amount of Potassium (kgs) applied per hectare
D_{HYV} = 1 if the respondent planted new varieties, otherwise zero
GOAL1 = farm and social status
GOAL2 = instrumental orientation
GOAL3 = independence orientation
GOAL4 = family orientation
GOAL5 = leisure orientation
RGOAL1 = farm status
RGOAL2 = business/development orientation
RGOAL3 = social and intrinsic orientation
RGOAL4 = social status
RGOAL5 = independence
RGOAL6 = country living orientation
ATTI1 = aggressive/openness in farming
ATTI2 = easy care farmer
ATTI3 = optimistic
ATTI4 = risk conscious & stressed attitude
ATTI5 = farm extension believer
ATTI6 = family and socially oriented
u = error term

All the explanatory variables that showed associations with efficiency in all models were combined and tested interchangeably taking into account the possibility of substitution among the components derived from Gasson (1973) as they were measured twice, though differently. Moreover, substitution may also occur between the items and the factor scores. By combining and substituting these components, it may be possible to better explain the variations in farmer's efficiency level.

The level of significance in hypothesis testing was set at 5 per cent. However, since this is an initial study of farmers' goals and efficiency, the level of significance in the goal and behaviour variables was set at 10 per cent.

7 The Research Locale and the Selection of the Study Area

The investigation was conducted in Negros, a small island in the Philippines (Appendix 1). The province has two pronounced seasons, the wet and the dry. The dry season is from late December to May for the northern part, and from November to May for the southern portion. The rainy season starts in June, reaches its peak in September and ends in October for the northern part. For the southern portion, the wet season begins in June, attains its peak in August and tapers off towards November (Aguilar, 1984).

The soil is considered to have come from two distinct origins: coraline and volcanic. The northern part of the province, largely influenced by the proximity of the seacoast, is of coraline origin. The southern part, especially the interior, strategically influenced by the presence of Kanla-on volcano, is of volcanic origin. In terms of slope, the northern and western parts of the province are generally considered to be largely level plains and gently rolling slopes while the remaining portion is practically a land of *sierras* (mountains) of varying elevation (Aguilar, 1984).

As shown in Appendix 1, the island is divided into two: Negros Occidental and Oriental. Negros Occidental has a total area of about 792,610 hectares. Of its total land area, 64 per cent is devoted to agriculture. Sugar comprises 55 per cent of the land use, thus accounting for it's largely mono-crop character (Guide to Negros Occidental, 1997). Negros Occidental occupies around 48 per cent of the total area planted to sugar cane (Sugar Regulatory Administration (SRA) Annual Report, 1997 and Extension Services Annual Report, 1997). It consists mainly of moderately sloping to rolling lands with slopes ranging from 0-18 per cent comprising about 70.9 per cent of the 563,100 hectares of the provincial land area.

Currently, Negros Occidental has 11 sugar milling districts which are divided into three areas - North, Central, and South Negros (Table 2). In CY 1996-97, the Central Negros area obtained the highest average yield per hectare, 111.91 fifty-kilogram bags (Lkg); while the South Negros area obtained the lowest, 83.05 Lkg/ha.

Table 2 Production Statistics for Negros Occidental Sugar cane Milling Districts, CY 1996-97.

Sugar Milling District	Total Area (hectare)	Total Sugar (50 (L) kg bags)	Yield (LKg/ha.)*
Central:			
Hawaiian Phils. / Aidsisa	11,202	1,500,060	133.91
Bac. Murcia & Talisay Silay	23,270	3,057,445	131.39
La Carlota	16,065	1,578,830	98.28
Ma-ao	9,928	834,511	84.06
North:			
San Carlos	9,835	1,063,858	108.17
Lopez	10,931	1,031,921	94.40
Victorias	30,097	2,770,767	92.06
Sagay/Danao	15,027	1,226,717	81.28
South:			
Biscom	27,271	2,516,531	92.28
Sonedco	11,209	971,727	86.75
Dacongcogon	8,935	626,557	70.12
		Average	97.52

Source: Sugar Regulatory Administration- La Granja Agricultural Research and Extension Centre, Extension Office Annual Report, 1997.

* This measurement is generally used in the sugar industry.

Since the aim of this study is to explain the economic, social and psychological factors influencing the variation in the production of sugar cane, it is necessary therefore, to minimise the differences in productivity due to environmental (ecological) factors particularly soil topography and types. It is important to ensure that all the holdings selected are similar, or that any variation is at a minimum. In view of this, Central Negros was selected. The variation in climate including temperature, sunshine, rainfall and humidity can be assumed to be small compared to the North and South Negros areas.

Within each area, the mill districts' sugar yields per hectare vary. Looking at the Central Negros area, Hawaiian-Phils./Aidsisa and Bac. Mur/Tal/Silay produced more than Ma-ao and La Carlota. Ma-ao's production per hectare is below the province's average production level while La Carlota's production is only slightly above the level. Therefore in order to have different levels of production efficiency, these four sugar mill districts were considered as they exhibited different levels of productivity. Another consideration was the accessibility of these four sugar mill districts given the time and budgetary constraints.

8 Collection of Data

A stratified random sampling procedure was applied. The sugar cane planter as a sampling unit was limited to the head of a farming household who is an owner-operator and/or lesee-operator, except for a farm manager.

The size of the sample was determined using the simplified formula for *n* in sampling for proportions given by Cochran (1977). The calculation of the sample size was also based on the cost and time invested with the acceptable error being set at 25 per cent.

The list of the respondents was taken from the SRA Planters' Directory CY 1997-98. Some respondents were replaced and the replacements taken from the same strata and in the same location.

The majority of the interviews occurred in the house, while a small number (especially for large planters) were interviewed in their non-farm work place. The data collection process was completed within 93 days (23 July 1998 to 23 October 1998).

A structured questionnaire was used in the interview. The questionnaires were pre-tested on a sample of farmers in the study area. The questionnaires comprised farm management factors (cultural practices, cost of production, etc.) and farmers' goals and attitudes. Gasson's (1973) goals were used and two methods of goal elicitation were applied: the 7-point Likert scale and goal ranking. In the first method, the respondents were asked to state the extent to which they believed such goals affected their operations on a scale of 7 (very important) to 1 (not important). In the second method, the respondents were asked to rank the goals from 1 (most important) to 20 (least, or not important). Questions relating to the farmer's attitude towards farming, technologies, government policies, farming business and decision-making were taken from Edinburgh Farming Attitude Scale (Willock, 1997) and Fairweather and Keating (1990) and were used after revision to suit sugar cane farmers socio-economic environmental conditions. A Likert 1 to 7 scale of importance was also used.

At the end of the survey, 44 planters were excluded. Some due to incomplete information, and some questionnaires were not returned. The remaining 127 respondents were used in the analysis. The collated data was encoded using FoxPro data base programming.

9 Treatment of Data

9.1 Farmers' Goals, Values and Attitudes. A principal component analysis was carried out on the 20 variables rated by the respondents. After each run, the components that explained the least proportion of variance were deleted. After the third run the remaining 13 sorts were again factored and the varimax rotation revealed that 68.1 per cent of the total item variance was explained by 5 factors with eigenvalues of 1.0 or larger (Table 3).

The first factor has articulated primarily by the five expressive values and accounts for a large proportion of the variance. This dimension (or factor) can be regarded as the farmer's social status or identity (GOAL1). Two of the instrumental values defined the second dimension. These objectives are essentially financial in nature (increase the family living standard and increase maximum farm income) (GOAL2). Two of the intrinsic values defined the third dimension: doing the work you like and being able to arrange hours of work. This dimension can be called 'independence' (GOAL3). The mixed social and instrumental values (*i.e.*, spend time with the family and save for children's education, respectively), which load on the fourth factor are attributable to a farmer's family-oriented values (GOAL4). The fifth factor comprised two of the intrinsic values and since the factor with the larger loading on it is that of more leisure time than country living, this dimension can be termed as 'leisure orientation' (GOAL5).

Table 3. Factors resulting from items related to farmers' goals and behaviour (elicited using 7-point Likert scale).

Item	Varimax Factors	Eigen values	% of variance
Factor 1 (GOAL 1- Farm and social status)		3.69622	28.4
• Be recognised as an owner of the land.	.78279		
• Be recognised as a top producer.	.75689		
• Be recognised as a leader in the adoption of modern technologies.	.83919		
• Be recognised as an adopter of modern technologies.	.82868		
• Be recognised as a sugar cane farmer.	.67108		
Factor 2 (GOAL 2- (Instrumental)		1.58077	12.2
• Increase standard of living.	.83978		
• Increase maximum farm income	.83044		
Factor 3 (GOAL 3- Independence)		1.30595	10.0
• Doing the work you like.	.74083		
• Being able to arrange hours of work.	.86886		
Factor 4 (GOAL 4- Family orientation)		1.21747	9.4
• Spend time with the family.	.72092		
• Save for children's education.	.84042		
Factor 5 (GOAL 5- Leisure orientation)		1.07967	8.3
• Live in a healthy, outdoor, farming life.	.56348		
• Have more leisure time.	.89403		

A principal component analysis was also performed on the same 20 variables but using the ordered ranking. The results of the factor analysis are shown in Table 4.

Table 4. Factors resulting from items related to farmers' goals and behaviour (elicited through goal ranking).

Item	Varimax Factors	Eigen Values	% of variance
Factor 1 (RGOAL1- Farm status)		2.61755	20.1
• Be recognised as a top producer.	.79472		
• Be recognised as a leader in the adoption of modern technologies.	.87577		
• Be recognised as an adopter of modern technologies.	.66288		
Factor 2 (RGOAL2- Business/development orientation)		1.80898	13.9
• Increase standard of living.	.64624		
• Increase maximum farm income.	.65166		
• Expand the business.	.68433		
Factor 3 (RGOAL3-Social & intrinsic)		1.48503	11.4
• Have more leisure time.	.84778		
• Leave business for next generation.	-.66678		
Factor 4 (RGOAL4- Social status)		1.20806	9.3
• Be recognised as a sugar cane farmer.	.73593		
• Be recognised as an owner of the land.	.82616		
Factor 5 (RGOAL5- Independence)		1.03293	7.9
• Doing the work you like.	.70899		
• Being able to arrange hours of work.	.81212		
Factor 6 (RGOAL6- Country living orientation)		1.01210	7.8
• Live in a healthy, outdoor, farming life.	-.79674		

The analysis reveals that 70.4 per cent of the total item variance is explained by the six factors (five in the previous method). The farm and farmer's social identity was split into two: The farm status (RGOAL1) remained in factor 1 while the two expressive values were loaded in factor 4 and thus termed social status (RGOAL4). The original two instrumental values in factor 2 (in Table 3), now became three with the inclusion of another instrumental goal- to expand the business and since it has the largest loading in this component, this dimension was termed business/development orientation (RGOAL2).

The mixed social and intrinsic values which load on factor 3 are the farmer's leisure and family oriented values *i.e.,* the objective of having more leisure time along with the long- term objective of maintaining the continuity of the farm business in the hands of the family (RGOAL3). Note, however, that the goals of doing the work you like and being able to arrange hours of work (factor 3 in Table 4) loaded on to the same factor-factor 5 (RGOAL5). The last factor (6) has only one goal this can be termed 'country living orientation' (RGOAL6).

The results of the factor analyses showed that there is some consistency between the Likert scale goal significance and the ranking method as shown in the principal components. Therefore it is sufficient to support the tentative conclusion that for this set of principal components, they appear to be nearly congruent. This may infer that one of the methods can be disregarded, as the components derived from scaling will show some collinearity with the components derived from the ranking method. However, it would be interesting to know which of these components, if any, explain variations in the farmer's efficiency levels. Thus, all of these components were initially included in the efficiency explaining relationships presented later.

The last set of explanatory variables - the farmer's attitudes, were also analysed and the results of the factor analysis are shown in Table 5. The analysis reveals that 65.3 per cent of the total item variance is explained by six factors with eigenvalues of 1.0 or larger. The first

factor expresses the concentration of the farmers toward technologies and obtaining farming business information – the Professional farmer (ATTI1). In contrast, factor 2, which expresses easy care farmer behaviour (ATTI2), involves a 'lackadaisical, take what comes' attitude.

The third factor is articulated primarily by the faith in the goodness of farming. The variable with the largest loading on it is a belief in the good outlook for sugar cane farming, followed by a belief that farming is security for retirement. The third attitude, the need for a cautious farm planning is somewhat dichotomous. Overall, this dimension can be regarded as having an optimistic behaviour, rather than a cautious approach for successful farming (ATTI3).

The fourth factor can be viewed as a risk related attitude involving both risk and the related stress (ATTI4). The fifth factor is expressed by farmer's attitudes towards farming technologies. The variable with the larger loading is a belief in the extension workers and therefore this dimension can be termed the farm extension believer (ATTI5). The sixth factor is articulated by the farmer's behaviours toward consultation in decision-making. This is basically family and social in nature, thus, its name (ATTI6).

Table 5. Factors resulting from items related to farmers' attitudes towards farming, new technologies, farm business and decision-making in the farm (elicited using 7-point Likert scale).

Item	Varimax Factor	Eigen Values	% of Variance
Factor 1 (ATTII- The Professional farmer)		3.35140	19.7
• New technologies improve the farm production.	.64523		
• It is important to read about farming technologies.	.67336		
• It is important to make maximum farm profit.	.63959		
• It is important to pay attention to market prices.	.66629		
• It is important to monitor the farm production level.	.71833		
Factor 2 (ATTI2- Easy care farmer)		2.41312	14.2
• Farming is a lonely job.	.68330		
• Farming problems may be ignored until they go away.	.85843		
• Successful farming is often due to luck.	.69443		
Factor 3 (ATTI3- Optimistic)		1.71054	10.1
• The long-term outlook for farming is good.	.81491		
• Farming is likely to provide a secure retirement.	.73883		
• Successful farming is due to cautious planning.	.50815		
Factor 4 (ATTI4- Risk conscious & stressed attitude)		1.50358	8.8
• Farming is too financially risky.	.84392		
• Nature of farming is stressful.	.75522		
Factor 5 (ATTI5- Farm extension believer)		1.09188	6.4
• Farming technologies can be sourced from extension workers.	.86340		
• New technologies have reduced the cost of production.	.80229		
Factor 6 (ATTI6- Family and socially oriented)		1.04207	6.1
• Families could be consulted about farm financial decisions.	.84228		
• Sometimes farming neighbours should be consulted before taking major decisions.	.67834		

It would be interesting to know if a simultaneous principal component analysis on all goal and behaviour variables would help explain efficiency. However, the separation of the variables will determine if the value orientations formulated by Gasson suits farmers in developing countries. Similar comments apply for the excerpts taken from the Edinburgh Farming Attitude Scale (Willock, 1997) and Fairweather and Keating (1990) as revised to suit the farmers in the Philippines.

9.2 Farm and Farmer's Characteristics (Including the Technology Adoption).

The human capital investment includes: (1) the farmer's years of formal schooling (EDUC); (2) the years in sugar cane farming (EXPER); and (3) the number of extension exposures (EXTN) for the past two years (*e.g.*, number of visits of farmers to demonstration trials and research centres, group discussions, training on farm practices, and extension advice on various farm practices).

The socio-economic characteristics of the farmer included the age (AGE) of the farmer at the time of the survey, the household (HHSZE) variable which records all the people living in the house, the off-farm work (OFFWORK) was the of hours spent on off-farm work per year. In addition dummy variables were incorporated, for the tenure status (D_{ow} =1 if the farmer was an owner operator, otherwise zero), for credit (D_{crdt} = 1 if the farmer had access to credit, otherwise zero), and for location (D_{Bac} = 1, if the farm is near Bacolod City, otherwise zero).

The variables for topography and soil type were measured as fractions of the area with flat (FLAT), slightly rolling (SROL) and rolling (ROL) topography, and the fraction of the area with clay loam (CLAY), sandy clay loam (SCLAY) and sandy loam (SANDY) soil.

Some cultural practices were applied more or less the same by all respondents, particularly the frequency of cultivation, weeding and fertilisation. Therefore, these practices were not included. However, a dummy variety variable (D_{HYV} = 1) was included if the farmer used a 1980s variety. Fertiliser was disaggregated into nitrogen (N), phosphorus (P) and potassium (K) variables to determine, as far as possible, which nutrients contributed to farm efficiency.

10 Results

10.1 Farm and Farmers' Characteristics (Including Technology Adoption). Around 44 per cent of the respondents graduated from college and this is reflected in the extent of the educational levels of the respondents, which is very high (12 years of schooling = second year in college) (Table 6).

Table 6. Selected farm and farmer's characteristics, including technology adoption.

Item	Mean	Std Dev	Minimum	Maximum
Farmer's human capital				
Years of education (EDUC)	12.54	3.3	3	21
Years of farming experience (EXP)	17.18	12.16	1	51
No. of exposures to extension (EXTN) in 2 years	9.44	21.85	0	200
Socio-economic				
Age (AGE) (years)	51.42	11.01	25	78
Household size (HH) (people)	3.94	1.92	1	8
Hours. in off-farm work/year (OFFWORK)	615.68	840.24	0	3120
Farm environment		Hectares		
Topography: Flat topography (FLAT)	18.31	31.09	0	156
Slightly rolling (SROL)	6.70	19.81	0	132
Rolling (ROL)	11.95	41.88	0	310
Soil types: Clay loam (CLAY)	17.11	45.91	0	310
Sandy clay loam (SCLAY)	7.49	20.25	0	120
Sandy loam (SANDY)	12.37	24.85	0	109
Adoption of technology		Hectares		
New varieties	17.86	34.58	-	270
Old varieties	15.12	28.97	-	227
Mixed varieties	3.99	10.14	-	59
		Kilograms per hectare		
Nitrogen (N)	377.52	111.65	36	729
Phosphorus (P)	139.41	82.37	0	368
Potassium (K)	179.28	153.37	0	480

At maximum, the respondents obtained either two college degrees or attended post-graduate studies. Around 27 per cent of the respondents had no exposure to any extension service. Although the maximum number of exposures to extension was high, the majority reported to have no more than 20 contacts (for two years) despite the average of 9.44. There were few younger sugar cane farmers, and, equally, few older ones. On average, the respondents were middle aged with a household size of around 4. Half of them have part-time jobs.

Seventy-one per cent of the respondents were landowners; 15 per cent were lessees, while the remaining 14 per cent were both landowners and lessees. The total cropped area was 4,694.29 hectares of which around 80 per cent was owned.

In terms of land topography and soil types, 49 per cent of the total area is flat, 19 per cent is slightly rolling while 32 per cent is rolling. The majority (46.3 per cent) of the total area is clay loam; around 20 per cent is sandy loam while 33.45 per cent is sandy clay loam. Only 48.37 per cent of the total area was planted to new varieties of sugar cane, 41 per cent to the old varieties, while 10.63 per cent was in a mixed variety. Fertiliser application varied from as high as 729 kilograms per hectare to no application at all, except for N fertiliser.

10.2 Farmers' Goals, Values and Attitudes. Table 7 shows the farmers' responses to the Gasson value orientations using a 7-point Likert scale (7 as very important). Among the value orientations, the instrumental values obtained the highest total mean (31.25), followed by intrinsic (28.91), social (26.7) and expressive (24.84).

Table 7. Farmers' goals and behaviour [after Gasson (1973)] elicited using a 7-point Likert scale.

Variables	Mean	Std Dev	Min	Max	*n*
Intrinsic					
1. Independence	6.17	1.23	2	7	123
2. Live in a healthy, outdoor, farming life	6.23	1.13	1	7	124
3. Doing the work you like.	6.11	1.08	2	7	124
4. Being able to arrange hours of work.	5.96	1.16	2	7	124
5. Have more leisure time.	4.44	1.63	1	7	124
Expressive					
6. Be recognised as a top producer.	4.85	1.73	1	7	124
7. Be recognised as a leader in the adoption of modern technologies.	4.98	1.57	1	7	124
8. Be recognised as an adopter of modern technologies.	5.16	1.47	1	7	124
9. Be recognised as a sugar cane farmer.	4.87	1.55	1	7	124
10. Be recognised as an owner of the land.	4.98	1.82	1	7	124
Social					
11. Involve family in decision making.	5.52	1.57	1	7	123
12. Leave business for next generation.	5.60	1.50	1	7	123
13. Employ more people.	4.52	1.53	1	7	124
14. Belonging to sugar cane farming community.	5.24	1.40	1	7	124
15. Spend time with the family.	5.82	1.37	1	7	124
Instrumental					
16. Increase standard of living.	6.46	0.90	2	7	124
17. Increase maximum farm income.	6.63	0.73	3	7	124
18. Expand the business.	5.98	1.39	1	7	124
19. Keep debt as low as possible.	6.09	1.48	1	7	123
20. Save for children's education.	6.09	1.73	1	7	123

Note: The four value orientations were taken from Gasson (1973) while some of the goals were revised to suit sugar cane farmers' socio-economic environmental condition.

The instrumental values that were placed as the most important by the respondents were 'to increase maximum farm income' and 'to increase family standard of living.' This was followed by the intrinsic values-'to live in a healthy, out door, farming life and being independent.' The least important goal was under the intrinsic (and not under expressive)- 'to have more leisure time.'

Among the social values, the goal was 'to spend time with the family' and 'to leave business for the next generation,' while among the expressive values, the most important goal was 'to be recognised as an adopter of modern technologies.'

Table 8 contains the results of the Gasson goal-ranking question.

Table 8. Distribution of farmer's ranking of Gasson's goals and behaviour items (from 1 as the most important, up to 20 as the least important objective).

	Gasson's goals and values	Number of farmers giving the rankings of:																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	*n*
1	Independence.	25	14	6	8	1	4	8	4	8	4	5	3	7	8	3	1	3	1	3	2	118
2	Live in a healthy, out-door, farming life.	9	6	12	10	13	10	5	11	7	4	10	4	3	4	1	4	1	4	1	1	120
3	Doing the work you like.	5	11	7	7	8	6	8	10	7	7	11	6	8	9	4	2	3	1	0	0	120
4	Being able to arrange hours.	5	2	6	11	10	10	6	9	5	10	7	8	1	5	2	7	9	2	3	2	120
5	Have more leisure time.	1	2	2	1	0	4	4	2	1	4	7	5	8	5	6	15	10	11	11	21	120
6	Be recognised as a top producer.	2	3	2	4	3	7	0	2	5	7	6	4	5	5	11	13	11	10	8	12	120
7	Be recognised as a leader in the adoption of technology.	1	1	3	3	3	3	4	4	5	5	10	11	6	7	8	15	9	11	6	5	120
8	Be recognised as an adopter of modern technology.	0	1	2	7	1	5	4	6	5	5	5	7	13	10	20	3	11	8	4	3	120
9	Be recognised as a sugar cane farmer.	2	3	0	1	6	0	5	2	5	6	4	6	8	9	11	12	9	9	15	7	120
10	Be recognised as an owner of the land.	4	2	3	2	2	5	8	2	7	4	6	4	6	6	8	6	7	17	8	13	120
11	Involve family in decision making.	3	2	6	6	11	9	5	10	3	9	6	10	1	8	3	6	6	4	5	7	120
12	Leave business for next generation.	3	2	5	4	9	6	6	5	10	11	4	9	11	5	3	6	5	6	5	5	120
13	Employ more people.	0	0	0	1	1	3	3	4	4	4	1	4	13	13	15	7	10	12	9	16	120
14	Belonging to sc farming community.	2	0	3	1	0	2	4	12	5	6	8	12	11	11	6	10	11	4	10	2	120
15	Spend time with family.	7	9	5	9	7	7	8	8	8	11	2	4	4	2	3	6	5	6	6	3	120
16	Increase standard of living.	10	14	11	10	15	7	9	8	7	6	7	3	3	2	5	0	0	2	1	0	120
17	Increase maximum farm income.	13	14	13	12	14	14	5	8	7	7	3	5	0	0	1	1	1	0	1	1	120
18	Expand the business.	7	2	15	8	7	7	8	2	12	7	12	4	4	2	3	3	6	4	6	1	120
19	Keep debt as low as possible.	5	16	13	3	3	9	13	7	5	8	3	6	1	7	3	1	2	5	4	6	120
20	Save for children's education.	35	16	9	11	4	2	5	4	3	2	2	4	4	0	2	0	1	1	6	9	120

Note: The four value orientations were taken from Gasson (1973) while some of the goals were revised to suit sugar cane farmers' socio-economic environmental conditions.

The majority (27 per cent) of the farmers ranked the objective 'saving money for their children's education' as their most important goal (score=1). This was followed by the goal 'being independent' as reported by 20 per cent of the respondents. Only 10 and 8 per cent of the respondents gave priority to 'maximise farm income' and to 'increase family's standard of living,' respectively, although there were also a few who valued these goals as the least important ones.

Perhaps because most of the respondents accepted that they have more leisure time in farming than in other occupations, this goal was not valued very much by some of the farmers. Around 16 per cent of the respondents ranked this as the least important goal (score = 20). Another less important objective was the 'employment of more people' as reported by 12 per cent of the respondents. This may possibly be due to the current production system as most of the farm operations in the farm today are usually conducted on a contract basis. Unlike the old system, due to the patron-client relation in the *hacienda* system, people are employed as temporary or casual workers; they do farm work during the peak season and non-farm work during the off-season.

The last set of measurements is the farmer's attitudes towards farming technology, farm business factors and decision-making [taken from Edinburgh Farming Attitude Scale

(Willock, 1997) and Fairweather and Keating (1990)]. The 7-point Likert scale was again used in eliciting the data and the results are shown in Table 9.

Among the farmers' attitudes toward farming, the items that obtained the highest total mean score was the belief that 'successful farming is due to cautious planning' and the 'long-term outlook for farming is good. The belief that 'farming is a lonely job' and that 'farming is often due to luck' were not accepted. In terms of farmers' attitudes toward farming technologies, the highest total mean score was the belief that 'new technologies improve their farm production.'

Among the farmers' attitudes toward farm business, on the average, they agreed that 'maximum farm income', 'to pay attention to the market price' and 'to monitor the farm production level', all had a high priority. However, they were ambivalent that other business is better than farming. In regard to the decision-making, on average, they agreed that it is necessary to consult with family and professional farming advisers before taking any major decisions on the farm. They tended to disagree that farming problems may be ignored until they go away.

Table 9. Sugar cane farmers' attitudes elicited using a 7-point Likert scale (7-strongly agree to 1-strongly disagree).

Variable	Mean	Std Dev	Min	Max	*n*
Farming					
1. Farming is a job like any other.	4.93	1.96	1	7	125
2. Farming is a lonely job.	2.65	1.73	1	7	125
3. Farming is satisfying.	5.63	1.27	1	7	125
4. Farming is too financially risky.	5.03	1.83	1	7	125
5. Nature of farming is stressful.	4.94	1.65	1	7	125
6. The long-term outlook for farming is good.	5.83	1.35	1	7	124
7. Farming is likely to provide a secure retirement.	5.29	1.62	0	7	124
8. Successful farming is often due to luck.	3.52	2.08	1	7	123
9. Successful farming is due to cautious planning.	6.40	0.83	4	7	125
New Farming Technologies					
10. New technologies improve the farm production.	6.49	0.84	4	7	125
11. Farming technologies can be sourced from sugar extension workers.	4.60	2.20	1	7	124
12. New technologies have reduced the cost of production.	4.83	2.04	1	7	124
13. It is important to use tried and tested ideas.	6.05	1.33	1	7	125
14. It is important to read about farming technologies.	6.44	0.76	4	7	125
Farming Business					
15. Farm business should be passed on to members of the family.	5.62	1.46	1	7	125
16. Modern record keeping systems are important.	6.18	1.12	1	7	125
17. It is important to make maximum farm profit.	6.49	0.80	3	7	125
18. It is important to pay attention to market price.	6.46	0.87	1	7	125
19. It is important to monitor the farm production level.	6.42	0.86	2	7	125
20. Other business is better than farming.	4.02	1.57	1	7	125
Decision-making					
21. Successful farmers take decision on their own.	5.18	1.65	1	7	124
22. Families should be consulted about farm financial decisions.	5.58	1.32	1	7	124
23. Sometimes farming neighbours should be consulted before taking major decisions.	4.58	1.52	1	7	125
24. Sometimes it is necessary to consult with professional farming advisers before taking decisions.	6.02	1.06	1	7	125
25. Farming problems may be ignored until they go away.	3.00	1.83	1	7	125

Note: The variables are taken from Edinburgh Farming Attitude Scale (Willock, 1997) and Fairweather and Keating (1990) were revised to suit sugar cane farmers socio-economic environmental condition.

The average Likert scale values for the constituents of the principal components presented earlier are shown in Table 10. The component that obtained the highest total average score *i.e.,* the most important component, was the instrumental orientation. The farm and social identification was the least important component.

Table 10. Average 7-point Likert scale value for the constituents of the calculated principal components.

Item	Total Ave. Score	Std Dev	Min	Max	*n*
Factor 1 (GOAL 1- Farm and social status)	4.97	1.283	1.4	7	124
Factor 2 (GOAL 2- (Instrumental)	6.54	.707	4.0	7	124
Factor 3 (GOAL 3- Independence)	6.04	.952	2.0	7	124
Factor 4 (GOAL 4- Family orientation)	5.96	1.245	1.0	7	123
Factor 5 (GOAL 5- Leisure orientation)	5.33	1.080	1.5	7	124

The average rank for the constituents of each principal component presented earlier is shown in Table 11. The component that obtained the least total average rank *i.e.,* the most important component, was the business/development orientation. The social status orientation was the least important component.

Table 11. Average rank (1-20) value for the constituents of the calculated principal components.

Item	Total Ave. Rank	Std Dev	Min	Max	*n*
Factor 1 (RGOAL1- Farm status)	12.94	3.95	3.0	19.00	120
Factor 2 (RGOAL2- Business/development orientation)	7.11	3.19	1.0	16.33	120
Factor 3 (RGOAL3-Social & intrinsic)	12.77	2.86	3.5	19.50	120
Factor 4 (RGOAL4- Social status)	13.37	4.32	1.5	19.50	120
Factor 5 (RGOAL5- Independence)	8.87	3.87	1.0	18.50	120
Factor 6 (RGOAL6- Country living orientation)	7.57	4.77	1.0	20.00	120

The figures in Table 10 and Table 11 showed similar results in terms of the most important goal components, that is, the instrumental aspects in farming. Also, both revealed that the farm and social status orientations were the least important goals, but with the latter as the least important one in Table 11.

The last set of explanatory variables- the farmer's attitudes, were also analysed and the results of the average scores of the constituents of the principal component analysis are shown in Table 12. The component that obtained the highest total average score was the attitude of a 'professional farmer' *i.e.,* the most agreed component, while the easy care-farming attitude was the least agreed one.

Table 12. The average scores of the constituents of the calculated principal component of the farmers' attitudes towards farming, new technologies, farm business and decision-making in the farm (elicited using 7-point Likert scale).

Item	Total Ave. Score	Std Dev	Min	Max	*n*
Factor 1 (ATTI- Professional farmer)	6.46	.574	3.6	7.0	125
Factor 2 (ATTI2- Easy care farmer)	3.04	1.46	1.0	6.33	123
Factor 3 (ATTI3- Optimistic)	5.84	.961	2.67	7.0	123
Factor 4 (ATTI4- Risk conscious & stressed attitude)	4.99	1.50	1.0	7.0	125
Factor 5 (ATTI5- Farm extension believer)	4.71	1.84	1.0	7.0	124
Factor 6 (ATTI6- Family and socially oriented)	5.08	1.18	2.0	7.0	124

10.3 The Associations between the Farm/Farmer's Characteristics and the Farmer's Goal and Attitude Orientations.

A multiple regression analysis was used to establish the association between the personal and farm characteristics and the farmers' goals and attitudes. A zero-order correlation matrix for the same variables was also conducted and the result is shown in Appendix 2.

Table 13 presents the statistically significant relationships. In the regressions, the factor scores of the components revealed better models in terms of higher coefficients of determination compared to those obtained using the item scores.

Table 13 The type and degree of farmers' characteristics that have significant association with the goals and attitude components.

Model	Constant	EDUC	EXP	EXTN	HH SIZE	OFF WRK	CRE DIT	FARM SIZE	% LAND OWNED	R^2	F-value
1. GOAL1 Farm and Social status	6.478 (1.039)				* -.126 (.068)					.062	.834
2. GOAL3[f] Independence	.269 (.795)		*** .028 (.010)						** -.613 (.292)	.110	1.554
3. RGOAL2 Business or.	6.938 (2.599)		** .067 (.033)							.093	1.249
4. RGOAL4[f] Social status	.380 (.827)							* -.004 (.002)		.063	.824
5. RGOAL5 Independence	12.133 (3.113)		*** -.109 (.040)							.115	1.591
6. RGOAL6[f] Lifestyle	.510 (.830)								* -.579 (.302)	.056	.719
7. ATTI1 Aggressive	6.178 (.450)				** .068 (.029)					.107	1.532
8. ATTI2 Easy care	3.668 (1.043)	*** -.186 (.041)							* .675 (.379)	.281	*** 4.916
9.ATTI3[f] Optimistic	-.874 (.803								* .513 (.297)	.107	1.448
10. ATTI4 Risk conscious	5.810 (1.089)	*** -.163 (.043)	** -.027 (.014)			** .0003 (.000)			*** 1.445 (.396)	.238	*** 3.987
11.ATTI5[f] Extension Believer	-1.581 (.795)	** .071 (.031)		* .007 (.004)						.124	* 1.709
12. ATTI6 Family/Social	4.14 (.860)			* .008 (.004)	*** .168 (.056)		* .390 (.321)			.233	*** 3.838

f = factor score
*** = significant at 1 per cent level
** = significant at 5 per cent level
* = significant at 10 per cent level

The adjusted coefficients of determination (R^2) are basically all very low although higher in Models 8, 10 and 12. However, the F-test values indicate some of the models are highly significant. These results suggest that other factors may explain the variations *e.g.*, asset value, or per cent debt, which this study was not able to capture.

Although the regression coefficients are quite low (lowest in extension and off-farm work variables and highest in per cent of land owned), the *t*-values of the variables express that the factors are worth taking note of.

Less educated farmers tend to perceive that success in farming is often due to luck and that farming problems may be ignored until they go away (ATTI2). They also tend to perceive farming to be too financially risky and stressful (ATTI4). Less experienced farmers also tend to have this kind of orientation and may be due to the extent of their knowledge in sugar farming. More educated and well-trained farmers on the other hand, are likely to believe in extension activities (ATTI5).

The two intrinsic independence (GOAL3 and RGOAL5) components are related with farmers' length of farming experience. In RGOAL5, less experienced farmers tend to perceive that there is more freedom in farming. However, it should be noted that previously held values of those who just entered farming from other backgrounds might have an influence. While in GOAL3, well-experienced farmers tend to believe they have more independence in farming. The reason may be due to farmers' specialisation thus making operating their farm relatively easy. The negative coefficient of 'per cent land ownership' in the GOAL3 equation may infer that the size of land owned by the farmers constrained their freedom. The length of farming experience is also positively related to the instrumental aspects (RGOAL2). That is, farming is viewed as a means of obtaining income and security.

The number of exposures to extension is also positively related to the family and social orientation (ATII6) attitudes of the farmers. Well-trained farmers tend to perceive that family, and sometimes farming neighbours, should be consulted first about farm financial decisions before taking any major decisions on the farm. Farmers with access to credit and a big household also tend to take on this kind of attitude.

The age variable had no association with any of the farmer's goals and attitudes in the data available. This is unusual as farmers' goals may change as they age, and their responsibilities and attitudes to life are likely to change. This may be due to its high correlation with the farming experience variable (refer to Appendix 2).

The size of the household is negatively associated with 'farm and social' identification (GOAL1). Children may involve economic constraints that tend to diminish the status derived from farming. This conforms to the relationship between household size and the instrumental aggressive attitudes (ATTI1).

Off-farm work (OFFWORK) shows a positive relationship with farmers' risk consciousness (ATTI4). This suggests that the more time the farmer spent off the farm, the more he/she tends to perceive farming to be risky and perhaps part-time farmers tend to be relatively risk averse.

The negative relationship between the size of farm (whether leased or owned) and the social status orientation (RGOAL4) may be connected to the lifestyle of those farmers who lease land as the goals related with the percentage of land owned are different. In Schroeder *et al*'s (1985 p.310) observation on the lifestyle dimensions of farming, they noted that the 'lifestyle motives of small farmers may be inferred from social class and reference group theory.' They cited Kahl (1957) who noted that style of life is a group phenomenon in which people 'model their behaviour after that of the people they hope to have as friends.' From this perspective, farmers may be involved in farming primarily as a means of gaining membership into a larger group known as 'sugar cane planters,' whom they perceived as being prestigious or powerful.

The 'per cent of land owned' is negatively related to the intrinsic independence orientation (GOAL3). This implies that big farm owners may value the economic attributes of farming although they may no longer feel independent because of their obligations and responsibilities to their workers. 'Freedom can be constrained by employees' (Gasson, 1974, p.133).

However, the 'per cent of ownership' is positively related to the easy-care farming attitude of the farmers. This is connected to the way farmers have handled farming problems especially on pests and diseases. In comparison to the rice and corn farmers in the Philippines, sugar cane farmers seldom spray their farms with insecticides or pesticides. In this study, only one respondent reported using pesticides and on a small scale.

Moreover, the 'per cent of land ownership' shows a direct relationship with the optimistic attitude (ATTI3). Farmers who own a large proportion of the farm perceived that the long-term outlook of the sugar industry was good despite its current problematic situation. This may be due to them seeing farming as a secure retirement option. And to be successful in farming, one has to consider cautious planning. The risk consciousness (ATTI4) of the farmers also shows a direct relationship with the 'per cent of land ownership.' Large farmers tend to be risk averse.

10.4 DEA Frontier Efficiency Levels. Five inputs [area (hectares), seeds (lacsa= 10,000 canepoints), NPK (kgs), power (hours) and labour (person-days)] and one output (tonnes cane) were used to measure the technical efficiency of the individual respondents. To measure the allocative efficiency, four inputs (costs of seeds and NPK, costs of labour and power, operating and maintenance cost, and land rental) and one output (sugar income) were used.

Only 24 respondents (19 per cent) were purely technically efficiency (PTE). The PTE index for the sugar cane farmers varies from 0.3945 to 0.9933. The scale efficiency index also varies from 0.698 to 0.98. The mean scale efficiency level is 0.9582 while the mean overall technical efficiency level is 0.9582. Of the 24 pure technically efficient farmers, only 12 farmers are scale efficient or overall technically efficient as they are operating at constant returns to scale; 51 are operating with increasing returns to scale, while 64 are operating with decreasing returns to scale.

Only 23 respondents (18 per cent) are allocatively efficient. The allocative efficiency index for the sugar cane farmers varies from 0.5018 to 0.9927, with a sample mean of 0.7777. Only half of the overall technically efficient farmers are allocatively efficient, thus they are economically efficient farmers. The mean economic efficiency level is 0.6025.

10.5 The Associations among the Farm/Farmer's Characteristics, Farmer's Value and Attitude Orientations, and Farmer's Efficiency. Many studies (Parikh *et al.,* 1995; Ali, 1995; Ali and Flinn, 1989; Battese *et al.,* 1996; and Wang, 1996) have found a negative effect of off-farm work with farmer's efficiency. However, in this study, off-farm work is positively and significantly correlated with farmers' technical efficiency (although the regression coefficient is very small) (Table 14). The reason may be due to the financial returns from off-farm work and the resulting cash injection. This could be related to the difficulty of obtaining loans for farm operations.

Table 14. Regression parameters for the models explaining purely technical, scale, overall technical, allocative and economic efficiency (Bootstrap sample c=100). (see p 11 for model definitions)

Variable	**Purely Technical** (Model D1)	Scale (Model D2)	Overall Technical (Model D3)	Allocative (Model D4)	Economic (Model D5)
Constant	1.160390 (.138178)	.756056 (.084694)	.827740 (.108863)	1.311387 (.227801)	.923695 (.159711)
Human capital variables:					
Education		.006620 (.004141)		-.005626 (.005420)	
Experience		.001805** (.000773)			
Exposure to extension	.001582 (.001340)		.001647 (.001100)		
Socio-economic variables:					
Age				-.001485 (.001408)	
Off-farm work (hrs)	.000037** (.000016)	-.000012 (.000008)	.000027* (.000015)	.000037** (.000019)	.000062*** (.000023)
Dummy (landowner =1)		-.037236 (.023800)			
Dummy (w/credit=1)	.022843 (.033686)				
Farm characteristics variables:					
Dummy (Bacolod City=1)				.083273** (.035556)	
Flat topography				-.067448** (.032374)	-.059307 (.044725)
Slightly rolling		-.017891 (.031542)			
Rolling		-.018581 (.019392)			
Sandy loam	.038095 (.035437)		.0562697* (.031950)	.060174 (.035096)	.079400* (.044489)
Adoption of technology:					
N (kgs/ha)	-.000217 (.000141)			-.000232 (.000153)	-.000463** (.000200)
K (kgs/ha)				.000257** (.000128)	.000352** (.000150)
Dummy (HYVnew=1)		-.025223 (.020738)		.057237** (.029073)	
Goals and behaviour variables:					
Goal 3		.003435 (.009637)			
Goal 5		.0110821 (.006940)	.021991* (.011510)		
Rgoal 1					.006167 (.004660)
Rgoal 2	-.008925* (.004966)				
Rgoal 4	-.005944 (.003655)				
Rgoal 5	-.008834** (.003915)		-.006935* (.004073)	-.008313** (.003837)	-.011968** (.005252)
Rgoal 6					
Atti 1				-.025021 (.024141)	
Atti 3	-.025710 (.016072)		-.029690* (.015431)	-.030114 (.018634)	-.047093** (.023244)
Atti 4	.006383 (.010886)			.011451 (.009236)	.025790* (.013988)
Atti 5		.007191* (.003689)			
Atti 6		.005664 (.007185)			
R squared	.1633	.3445	.1561	.2562	.2179
F-Value	2.0499**	5.1593***	3.3599***	2.7024***	3.31778***

The standard errors are given in parenthesis.
* = significant at 10 per cent level ** = significant at 5 per cent level *** = significant at 1 per cent level

The importance of off-farm work may also be related to the cultural characteristics of the crop. Sugar cane is commonly known as the 'lazy man's crop'. The growing of sugar cane is not intensive compared to other crops such as rice and corn. Also, it takes 10 –12 months before it can be harvested, and many farm operations *e.g.,* fertilisation, cultivation and weeding are carried out by wage-labour (on a contract basis). Therefore, the farmers have to look to other sources of income especially during the off-season for their farms and families' maintenance.

Only two of the goal predictors are statistically associated with farmers' technical efficiency. The regression coefficient of RGOAL2 (business/development orientation) is negative and significant at $p = 0.05$ level. This is unexpected as it shows that inefficient farmers tend to give higher importance to the instrumental aspect of farming than the efficient ones. It should be emphasised that when the instrumental goals (especially the goal to maximise farm output or income) were elicited, doubts on whether these goals could be measured properly were raised. During the interviews, most of the farmers considered these goals to be important, but when the farm performance was reviewed, few achieved maximum output. That is, many farmers are concerned about the instrumental aspects of farming, but not all who consider them to be important are performing efficiently.

The regression coefficient of RGOAL5 is also negative, and highly significant, so inefficient farmers tend to give higher importance to freedom and independence than the efficient ones. Freedom in this sense may mean the ability to set one's work place and be free of close supervision. During the interview, the respondents indicated that the goal of 'doing the work you like' and 'being able to arrange hours of work,' could be satisfied if working on the farm. This may suggest that farmers are in business to provide a basic income, but they do not aim for maximum production in their allocation of time and effort.

The 'social status' (RGOAL4) variable also shows a negative coefficient which is closely significant at 0.05 level. That is, the inefficient farmers are more likely to give high importance to social identification. This is very typical of sugar cane farmers. To be recognised as sugar cane farmers (planters or *hacenderos* as they call themselves) and to be recognised as the owner is sufficient to keep them from growing other crops. It seems that farmers tend to identify strongly with farming, even though their occupation is something else as reflected in the direct and significant effect of OFFWORK. The reason may be due to the social make-up in the sugar industry wherein the landholding is the measure of political power as well as social and economic prestige.

The effect of the EXPE (experience) variable on scale efficiency is positive and significant at $p = 0.05$ level. This indicates that expertise probably assists in ensuring the optimal timing and use of inputs. However, in the overall technical efficiency model, among the human capital investment, only the EXTN variable entered the regression equation and the sign is positive although not significant. This suggests the training, seminars and other extension education is a weak predictor of the overall technical efficiency levels of the farmers. However, the data available is not sufficient to put heavy weight on this result.

On the other hand, the effect of OFFWORK on scale efficiency was negative. That is, the greater number of hours spent in off-farm work, the greater the inefficiency level. However, the coefficient was not significant and therefore the null hypothesis is accepted. A contrasting result was obtained in the overall technical efficiency. A statistical relationship exists between off-farm work and overall technical efficiency ($p = 0.10$ level). The reason is probably the highly significant effect of off-farm work on technical efficiency.

The positive effect of sandy loam soil to overall technical efficiency may be attributed to technical efficiency. In regard to topography, the farms with slightly rolling and rolling topography show a negative relation with scale efficiency. It might be expected that slightly

rolling and rolling terrain would have an adverse impact on efficiency. However, in this analysis, the results are insignificant. Around 77 per cent of the area has clay loam type of soil. This type of soil may have counteracted the long dry spell brought about by the El Niño as it can hold more soil moisture and nutrients. It is also less prone to soil erosion.

The regression coefficient of the 'extension believer' (ATTI5) variable is positive and significant at $p = 0.10$ levels. That is, efficient farmers tend to have a positive attitude towards technology generated by the extension workers and that this technology helped and guided them to operate their farm optimally.

Overall, two of the goal variables measured on a Likert scale, and one variable measured by ranking, entered the regression equation. All were expressed as the total average score of the components. The regression coefficient of the GOAL5 variable is positive and significant at $p = 0.10$ level, so efficient farmers tend to give higher importance to having more leisure time and wanting to live a healthy, out-door, farming life. Meanwhile, the farmers' independence orientations (RGOAL5) effect on overall efficiency is still negative. Moreover, the regression coefficient of the ATTI3 variable (a weak predictor in purely technical efficiency) now becomes a significant predictor of farmers' overall technical efficiency although the relationship is negative. That is, the efficient farmers tend to be less optimistic than the inefficient ones. The significance of the goal/attitude variables should be noted in that these results support the notion that a lot of apparent inefficiency is not considered inefficiency by the farmers.

The OFFWORK variable shows a positive and significant effect to farmers' allocative and economic efficiency (at $p = 0.05$ level and $p = 0.01$ level, respectively), although the regression coefficients are very small. As noted earlier, the allocation of more time to off-farm work may have produced extra income that enabled the farmers to apply appropriate technology and their off-farm work may have provided information that helped their financial operations.

As expected, the location variable is a positive and significant predictor to farmers' allocative, but not economic efficiency. Farms located near Bacolod City (D_{BAC}) appear to be allocatively efficient. Most of these farmers in this district live in Bacolod City and therefore have access to cheaper farm inputs and thus impact on allocative (price) efficiency.

The farms with flat topography might be expected to have higher profitability considering that they are cheaper to operate than those farms with slightly rolling to rolling terrain. In addition to this, around 33 per cent of the total flat area is located near Bacolod City and the majority (71 per cent) of large farms are flat (mean =75.78 hectares).

However, the effect of a flat topography on farm profitability is negative. This result is contrary to expectation, considering that more than 48 per cent of the flat area is planted with new varieties and the N P and K fertiliser applied per hectare is also highest on the flat area (the means are 385.60, 147.98 and 199.88 kgs/ha., respectively) compared to the slightly rolling (381.02, 138.06 and 159.87 kgs/has.) and rolling areas (365.88, 121.93 and 141.46 kgs/has). One possible factor may be the type of soil. Around 46 and 37 per cent of the flat area is sandy and clay loam respectively. Only 25 per cent is sandy clay loam. For a flat area, the ideal type of soil is sandy clay loam as low-lying land floods easily so that coarse-textured soils are desirable especially in areas with heavy rainfall (Handbook of Sugar Cane Growing 1981). This means a flat area with sandy clay loam may yield more production in good weather conditions but the drought in Crop Year 1997-98 may have interfered. However, in the economic efficiency model, the FLAT and SANDY variables are weak predictors of efficiency.

The use of improved seed (D_{HYV}) had a positive and significant effect on allocative, but not on economic efficiency. The significance of the dummy variable (D_{HYV}) may also reflect the low use of improved varieties as only 48 per cent of the total area is planted with new varieties.

The N fertiliser variable shows a negative and insignificant impact on allocative efficiency but it shows a significant effect on economic efficiency. The minus sign may be due to improper application of N fertiliser. However the application of K fertiliser has a positive and a significant effect in both types of efficiency. The significance of the K fertiliser variable implies that the application of K had an high payoff. This may be due to the soil fertility status of the sugar cane land in the Philippines as they are deficient in potassium, especially those that have been used continuously without corrective liming (Atienza, 1980).

It seems that farmers may have applied too much N in relation to K. Heavy nitrogen fertilisation could increase soil acidity and aid the depletion of soil potassium and other micro-nutrients. Moreover, it could also aggravate leaf diseases and impair the proper ripening process of sugar cane (Rosario *et al.,* 1992).

Two of the attitude predictors are negatively associated with farmers' allocative efficiency. This is unexpected as this implies that inefficient farmers tend to more optimistic (ATTI3) and aggressive (ATTI1) than the efficient ones. The regression coefficient of RGOAL5 is also negative and significant. That is, inefficient farmers tend to give importance to freedom and independence. It may be these farmers were never efficient because of their preference for intrinsic independence rather than for the instrumental aspects of farming. However, if current income is satisfactory, most people will value other things.

The 'optimistic' (ATTI3) variable had a significant relationship, possibly due to the slight impact of ATTI3, on the farmers' pure technical efficiency and allocative efficiency. However, its (ATTI3) relationship with economic efficiency is negative and significant *i.e.,* inefficient farmers tend to be more optimistic towards farming than the efficient ones. Moreover, the relationship of the 'intrinsic independence' (RGOAL5) variable is also negative with economic efficiency. That is, inefficient farmers tend to value the work they like and being able to arrange hours of work. They tend to put more stress on these values than on the value of making a satisfactory profit. However, there is one significant attitude variable that explains positively the farmers' economic efficiency- ATTI4. This relates to the farmers' risk consciousness and this attitude may have guided them to become more economically efficient.

Again, all these findings support the idea that the farmers may be content to be technically and allocatively inefficient. Nevertheless, this study found two major farm management styles that reflect the combination of sugar cane farmers' lifestyle and economic goals. These are shown in Table 15.

Table 15. Different management styles in sugar cane production, Central Negros, The Philippines.

Efficient farmers	Inefficient farmers
Extension believer (ATII5) • Farming technologies can be sourced from extension workers. • New technologies have reduced the cost of sugar cane production. Risk conscious (ATTI4) • Farming is too financially risky. • Nature of farming is stressful.	Intrinsic independence (RGOAL5) • Doing the work you like. • Being able to arrange hours of work. Optimistic (ATTI3) • The long-term outlook for farming is good. • Farming is likely to provide a secure retirement. • Successful farming is due to luck.

The efficient sugar cane farmers tend to believe in new technologies and interaction with extension workers. They also believe farming is stressful and risky. Inefficient farmers tend to put intrinsic values [8] ahead of economic goals and pursue a way of life with roots in the rural areas. They also see success in farming as due to luck.[9] Thus, one might question whether the 'inefficient' farmers would accept that they are irrational.

11 Conclusions and Implications

11.1 The Techniques. There are advantages in using the DEA technique. The construction of the 'efficient frontier' for measuring efficiency is achieved without having to make any assumptions regarding the underlying functional form and the statistical errors associated with the specification of such a function are also avoided. Moreover, the technique produces relative efficiency scores. That is, the assessment establishes which farmers are efficient in comparison with the other farmers in a certain situation. This is very useful if a farmer wants to determine where he/she stands relative with each other. If he/she wants to be 100 per cent efficient, he/she could adopt the technologies of the best practice farms (efficiency score = 100%) and learn the associated management skills.

The drawback of the DEA approach is its sensitivity to changes in the input-output specification. Thus, a large number of DEA runs were carried out and various grouping techniques were employed to assess sensitivity. The analysis yields information on how the units perform only at the level of the component inputs and outputs included. Moreover, as the DEA efficiency scores are relative to each other, direct regression with other selected-efficiency variables cannot be applied. In contrast, the Bootstrap method used in this study proved to be successful in removing the dependency of the DEA scores as shown by the increase in the significance values of the parameters.

In the principal component analysis, the results showed that there was consistency in the goal measurements in that the components obtained from the Likert scale assessment and the ranking method were more or less similar. The components derived from scaling showed some collinearity with the components derived from the ranking method. This suggests that either method can be used, although in the regression analysis, two of the components derived from the Likert scale were predictors of allocative efficiency. Moreover, the use of item scores (not the factor scores) of the components proved to be more useful.

11.2 Farmers' Characteristics and Their Association with Goals and Attitudes. The results presented in this study clearly indicate the important influence of social and psychological factors on farming behaviour. The 'per cent of land owned' variable has a relatively strong association with almost half of the components *e.g.,* intrinsic independence and lifestyle orientations, easy care, optimistic and risk consciousness attitudes. Therefore, it is suggested that the 'per cent of land owned' is the most important variable in explaining differences in goals and attitudes of the farmers. This suggests that the 'proportion of land owned' is a major factor related to the farmers' decision-making and thus their production efficiency. The real question, of course, is whether historical facts give rise to its value, or

[8] This is a very typical attitude of a Filipino. According to Andres (1981, p.21) 'The Filipino time-orientation is psychological rather than mathematical; cyclic, not linear; relative, not exact. Time is for the person. It fits every happening harmoniously into the scheme of life and nature. For the Filipino it is easy to accept any event, because all things come in their own good time.' The origin of this trait can be traced in history. One of the time-orientations inherited from the Spanish is the *mañana* habit (or procrastination). It is the disposition of staving off responsibility to another day. Filipinos' productivity is greatly hampered because of this attitude (*ibid.*).

[9] This is a very typical belief of a Filipino based on Spanish Catholicism and mixed with pre-Spanish superstition and pagan beliefs Andres (1981). As Andres, (1981, p.21) notes: 'The Filipino conceives success as due more to luck, fate, God's mercy [...] Failure is explained in a similar manner. A poor harvest is not due so much to poor irrigation or poor seed, as to bad luck.'

whether the farmers' characteristics give rise to it. In reality, it is probably a combination of both.

The goals and attitude relationships of farmers in developed countries seem to be similar with the farmers in the Philippines. For example, the positive effect of education on farmers' attitude towards new farming technology (ATTI5) was consistent with the description of Van den Ban and Hawkins (1985) who characterised well-educated farmers to be quick in adopting innovations.

The negative effect of farm size on social identification (RGOAL4) may be connected to the lifestyle of the non-farm owners (as the goals correlated with the percentage of land owned are different). This conclusion is similar with the observation of Schroeder *et al.,* (1985) on the lifestyle dimensions of farming. Small farmers may be involved in farming primarily as a means of gaining membership into a larger group known as 'sugar cane planters' whom they perceive as being prestigious or powerful.

This also lends support to the argument of Gasson (1974 p.136) on the socio-economic status and orientation to work of the East Anglian farmers. Using farm size as a proxy for a social class of the respondents, she notes: ' Members of lower socio-economic groups might therefore be expected to value work chiefly for instrumental ends, [...] while those with high status, economically secure and socially accepted, might value their occupation most for its intrinsic content.'

Since most of the evidence presented in this study refers to farmers in Negros (above the South Island) it would be useful to repeat the survey in other regions, especially Luzon, the 'sugarbowl' in the North Island. Luzon farmers are known to be business-minded. It would be interesting to learn whether, for instance, farmers elsewhere display a more instrumental and less social approach to farming. These relationships have implications for agricultural policy makers and those advising individual farmers. Different approaches may be appropriate for farmers at different socio-economic levels. For example, if the results of this study are substantiated, small farmers would be likely to reject any proposals which threatened their highly valued independence.

11.3 Efficiency Levels and Measurements. The pure technical efficiency (PTE) index for the sugar cane farmers varies from 0.3945 to 0.9933 so there is a potential for some to increase farm output by approximately 60 per cent from the existing inputs. However, the mean efficiency level of 0.7777 implies that on average the respondents are able to obtain around 78 per cent of potential output from a given mix of inputs. The adoption of the practices of the efficient farms, therefore, could theoretically increase output by 22%.

The scale efficiency index also varies from 0.698 to 0.98. The mean scale efficiency level of 0.96 and the mean overall technical efficiency level of 0.74 implies that the major source of the overall technical inefficiency appears to be pure technical, as against scale efficiency. This suggests that by eliminating scale inefficiency and pure technical inefficiency, the Philippine sugar industry could increase overall technical efficiency by 26 per cent by operating at the optimal scale and by eliminating pure technical inefficiency through the adoption of the best practices.

In eliminating scale inefficiency, each farm should be examined first to determine whether it is already operating at its optimal scale, or whether production can be increased through moving to the optimal scale. The DEA technique can indicate an optimal size based upon each farm's particular input-output composition.

The allocative efficiency index for the sugar cane farmers varies from 0.5018 to 0.9927, with a sample mean of 0.78 which implies that on average the respondents could reduce their

factor costs by about 21 per cent without reducing their current output. The reduction in costs from improvements in efficiency is very important to enhance profitability, especially for small farmers who earn a negative net return from sugar cane production.

Only half of the overall technically efficient farmers are allocatively efficient, thus they are economically efficient farmers. The mean economic efficiency level of 0.6025 implies that there exists a potential for increasing the profitability of the farmers by 40 per cent simply by adopting the technology of the 'best practice' farms and through optimal resource-allocation. However, remember that these results relate to the position of the 'efficient' farms. It might also be possible for these farms to in fact improve their efficiency through 'perfect' management.

11.4 Selected Variables and Farmers' Productive Efficiency. Keeping in mind the low R^2 values in many of the results, some tentative policy implications can be made.

As the level of farming experience helped explain scale efficiency, this suggests management skill aspects such as the optimal timing of operations are important. It also suggests that extension education could be effective by targeting farmers with longer farming experience, and those with higher years of schooling (Note that the regression coefficient of the EDUC variable was also positive and nearly at the 10 per cent level of significance). Also, on-the-job training could affect the efficiency of the individual. Perhaps, non-formal education, or government continuing education and extension services, and other farming innovations and new techniques, should be strengthened among sugar cane farmers, especially the small ones.

Off-farm work as an indicator of non-farm income proved a significant predictor of pure technical, allocative and economic efficiency. Non-farm income and farm productivity is linked. The income could be a critical means to pay for farm inputs and investments, and to achieve food security. In this study, around 50 per cent of the respondents have part-time jobs and the majority (67 per cent) of them are small farmers whose farms are located far from the city. It appears that the small farmers' basic source of income comes from their off-farm work. Most often, small farmers have less access to non-farm jobs and thus an ability to start a small business. This is concerning as unequal access to non-farm income translates into unequal access to farm inputs in the face of limited credit access. Therefore, micro-enterprise promotion programs that provide rural employment are desirable.

The significance of the location dummy (D_{BAC}) variable implies that input cost differences across farms could exist. Different farmers face different prices due to transaction costs *i.e.,* farms located near the city may have lesser input costs. Therefore, an effort should be made to identify cost-effective ways of increasing access to inputs and improving their delivery for farms not located near the city (and for small farms as well. It should be noted that input cost differences also exist across different farm sizes. There was considerable evidence showing large farms have a comparative advantage in obtaining a lower price for their inputs *e.g.,* seeds, fertiliser and credit). One way is through the co-operation of the different planters' associations (located in each district) and say, manufacturers of fertilisers. Farmers could get their fertiliser at a lower cost due to less transaction costs plus the discount that could be obtained by the Association in bulk buying of fertiliser. The fertiliser could be paid in cash or by deduction from the farmers' sugar.

The negative effect of the nitrogen element is alarming. Information regarding the time and proper application of fertilisers should be disseminated to increase its economic benefits. The result also suggests that an excessive amount of nitrogen impedes production as it is harmful not only to the plant, but to the soil environment as well. This should be corrected. Practices that prevent erosion and help water retention and thus increase productivity by increasing soil moisture and the effect of fertiliser should also be encouraged.

The significance of the dummy variety variable may reflect the low use of improved varieties. The Accelerated Nursery Development Project of SRA maintains a nursery for canepoint distribution to the different planter co-operators. To attain rapid multiplication of the recommended varieties, SRA embarked on the Micropopagation Project. As of 1999, five micro laboratories are in operation. Diverse forms of extension services are also used (*e.g.* farm and home visits, consultation/referrals, group meetings and recently the Outreach Program for the Sugar Industry, a 5-day training for sugar cane farmers, managers, overseers, foremen and the like). However, despite these extension approaches, still, some of the improved technologies have not reached the beneficiaries as most extension services have been stopped due to budgetary constraints. Therefore, the Sugar Regulatory Administration should allocate more budget for its agricultural extension activities. The First Farmers Planters' Association has its own extension staff. It is noteworthy that the Hawaiian-First Farmers-Aidsisa district has the highest productivity among the districts in Negros Occidental. Therefore it is suggested that private extension should also be established.

Business management must be integrated into every training workshop and seminar with special emphasis toward the instrumental aspects of farming. When farmers understand the benefits of having a productive and profitable farm, they are more likely to look after their crop efficiently, and more likely to adjust their input use with the changes in costs.

Inefficient farmers tended to forego profit to achieve freedom and independence.

Efficient farmers tended to value non-financial benefits such as leisure and wanting to live in a healthy, out-door, farming life (GOAL5). These findings lead to the conclusion that a good farming environment leads to farmers' productive efficiency. Half of the respondents live in the city and today most of the sugar cane farmers live off their farms, and even outside Negros Island. If these farmers could be made to return to their village, the country may return to its original position as a net exporter of sugar. As a saying goes: ' the footprints of the farmers will determine the productivity of their farms.' Therefore to induce farmers to stay on the farm any scheme *e.g.,* an appropriate infrastructure, peace and order to make country living more acceptable, is likely to help increase their overall efficiency.

Efficient farmers tended to perceive that farming is financially risky. One way to reduce risk (*e.g.,* from imperfect information, or price volatility due to a thin market) is to have a well-functioning market. Markets are also an indirect determinant of farm productivity as they affect profitability of farming, outlets and input access. A well-functioning market would help farmers acquire and use improved inputs and profitably sell outputs by reducing transaction costs and risks.

Moreover, this study found two major farm management styles that reflect the combination of sugar cane farmers' lifestyle and economic goals. The efficient sugar cane farmers are adopters of new technology and seem not to avoid risks while the inefficient farmers put intrinsic independence values ahead of economic goals and look to farming to provide a secure retirement. They see luck as an important component of success.

12 Research Limitations

The empirical results of this study should be interpreted with some caution considering the following. One limitation was the limited amount and quality of the production data. The fact that farmers were asked to provide information on events, which took place a year earlier than the time of interview. For example, some could not remember the date, place of purchase, and prices of farm inputs; and the frequency of attending field days, meetings and seminars.

There could be many other non-recorded factors that might explain farm efficiency as complicated production systems and varied farm practices are used. Moreover, the data required preliminary coding. Undoubtedly, all these factors could have introduced some errors.

Furthermore, the quality of hired farm workers was overlooked and thus relevant in the efficiency model and in identifying the various sources of inefficiency. However, this limitation is not likely to be unique to this study.

The crop year used may not be typical due to the occurrence of drought caused by the El Niño phenomena so the farm efficiencies may be related to this phenomenon and the results may apply for this crop year only. Therefore, additional years of data will be required to shed more light on the importance of the various factors affecting sugar cane production efficiency, though it must be remembered that the DEA analysis relies on relativities rather than absolute values so different years' data may not impact. This analysis is required to ensure the success of policy changes that have the potential to greatly improve the welfare of the sugar cane farmers in the Philippines, as well as the economy.

13 Recommendations

On the basis of the findings the following measures are suggested:

13.1 For Future Research. The study shows that farmers' lifestyle values relate to their determination to remain in sugar cane farming. Future research on agriculture will need to pay more attention to measuring the importance of lifestyle choices of those who continue to be active in farming. Especially important will be the analysis of the relationship between economic and lifestyle variables in understanding the continuing production of sugar cane at an economic level. Are economic and lifestyle values competitive or complementary in motivating sugar cane farmers to maintain their production?

The study also shows that results of goal ranking differ somewhat depending on the method of elicitation and analysis used. The variation tends to be greater when a wider range of expression is allowed through goal ranking (from 1 to 20) than in the 7-point Likert scale. Further research needs better-designed instruments for giving more reliable measures. This may increase the explanatory power of the models considered. It should also be noted that around 2 to 3 goal and attitude variables appear in the different efficiency models.

The R^2 values ranged from 0.1633 to 0.3445 and this implies that around 66 to 84 per cent of the variations in the farmers' efficiency still remains to be captured and explained. This will pose a tempting challenge to the future researchers. This study did not capture important management aspects in the regression models. Such variables on the time of farm operations, *e.g.*, weeding and fertilisation, may well explain much of the variation in efficiency. Also, perhaps the variations in farmers' efficiency based on cross-sectional data covering one year is not sufficient to obtain clear explanations and this must also be considered.

13.2 Administrative Policy Formulation. For the education planner, there is a need to consider the elementary and secondary curricula to include sections on Filipino values that may lead to the development of cognitive and affective skills in entrepreneurship among the young generation. The results indicate that the present farmers lack an entrepreneurial spirit- a condition that limits their production efficiency.

For the Sugar Regulatory Administration, there is a need to further strengthen the Agricultural Research and Development office, particularly the extension component. Investment in extension education should be considered a central ingredient in a strategy designed to improve agricultural productivity, especially when technology is dynamic. For

farmers to perceive and respond efficiently to changes in technology (and market prices) requires an ability that is acquired by investing in extension education and useful information.

The results showed that research should be geared towards the use of improved varieties. Currently, the Sugar Regulatory Administration and the Mill District Development Foundations (located in each district nationwide) have nursery farms and a few micropropagation laboratories to produce plantlets. Despite this the old varieties occupy the majority of the sugar cane hectareage due to the inaccesibility of canepoints and plantlets by the small farmers. A review of the seed multiplication and distribution project should be conducted.

As the effect of soil type is relatively significant, soil management practice research should be given priority. Shifting sugar cane to more fertile soils would enhance efficiency, although the scope for doing so is limited due to land availability. Nevertheless, the productivity of the soils could be improved by developing their physical and chemical properties through soil conservation, improved cultural practices (trash farming), fertiliser use and so on. A soil analysis program, such as in the Bukidnon mill district (south of Philippine Island) should be adopted nationwide. The extension service responsible for the dissemination of information on the importance of soil analysis should be considered a serious instrument for increasing agricultural production and thus profit. This service should also be reviewed periodically to improve its efficiency.

The majority of the financial establishments are highly concentrated in the City of Bacolod. In order for rural development to take place, a more decentralised distribution of credit and banking facilities should be in place. Capital should be provided conveniently and in sufficient amounts to service the capital needs of the farmers and other borrowers.

The sugar mills could also promote agricultural partnerships. Millers could give credit and technical guidance to small producers in return for the delivery of a specific quantity and quality of cane at a stipulated time. The collective efforts of these farmers and millers, once harmoniously co-ordinated, can enhance production efficiency and economic prosperity.

One way to attract farmers back to their farms is to give them a peaceful place to live in. This is a contribution that the police and the military could provide.

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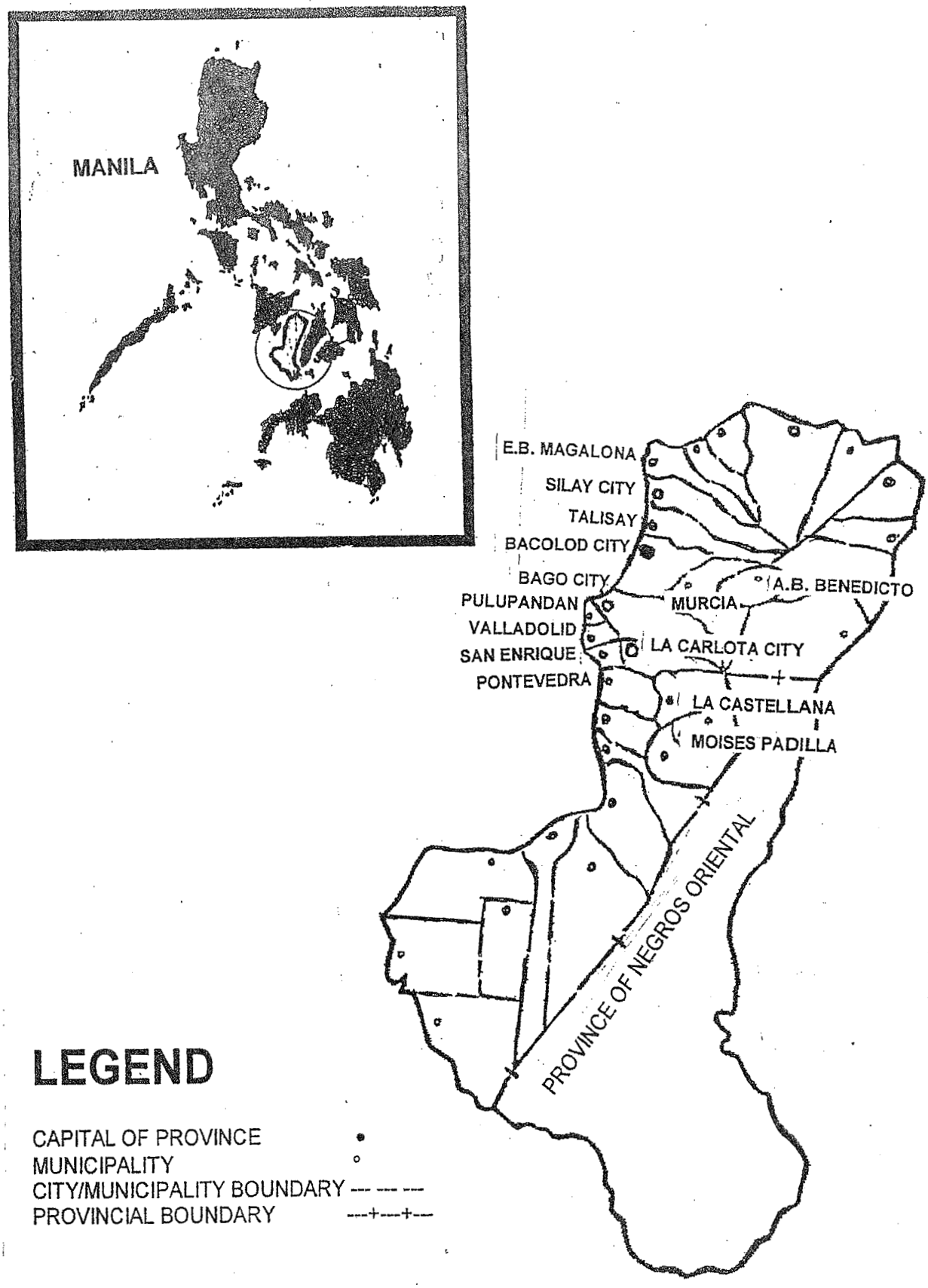
APPENDIX 1

Map of the Philippines and Negros Island



Appendix 2

Table A8-1.1 Zero-0rder correlation on matrix for sugar cane farmers' goals, values and attitudes for selected variables.

	RGOAL 1	RGOAL 2	RGOAL 3	RGOAL 4	RGOAL 5	RGOAL 6	ATT1 1	ATTI 2	ATTI 3	ATTI 4	ATTI 5	ATTI 6	EDUC	EXP	EXTN	AGE	OFFWO	FSZE	D_{CRDT}	D_{OW}
RGOAL 1	1																			
RGOAL 2	-.2947**	1																		
RGOAL 3	-.2448**	.0396	1																	
RGOAL 4	.2363**	-.1133	-.1284	1																
RGOAL 5	.047	-.1806*	-.1836*	-.1452	1															
RGOAL 6	.0092	-.1516	-.1522	-.1409	.2181*	1														
ATTI1	.0224	-.0454	-.0791	-.0942	.0487	.0555	1													
ATTI2	-.1019	-.1183	.0487	.1215	-.0094	.0298	-.0551	1												
ATTI3	-.1259	.0398	-.027	-.0848	.0962	.0143	.2344**	.0102	1											
ATTI4	-.0147	-.0616	-.1173	.1113	.1751	-.0206	.1392	.3756**	.1359	1										
ATTI5	.0905	-.0368	.0095	.2413**	.1256	-.1038	.1802*	-.0147	.0704	.096	1									
ATTI6	-.107	-.0834	.0441	-.115	.1412	.2033*	.3683**	.0843	.2523**	.1485	.0199	1								
EDUC	.0439	.1145	.018	-.082	-.1624	-.1642	-.0983	-.4657**	-.1658	-.3011**	.1832*	-.2143*	1							
EXP	.0217	.1977*	-.0366	.1021	-.2496**	-.132	-.1261	-.1173	-.105	-.1915*	.0873	-.2720**	.2258*	1						
EXTN	.0665	-.1052	.0637	.0843	.0452	.0099	.1162	-.0239	.0628	.1087	.1605	.1362	.1094	.034	1					
AGE	-0.017	.055	-.0177	.0516	-.1101	-.0043	-.1186	-.0356	-.0404	-.1384	.1039	.2029*	.1459	.5988**	-.0104	1				
OFF WORK	.0435	-.0681	-.001	.0174	.0416	.1062	-.0635	.0159	.0867	.1189	.0194	.0697	.0628	-.0427	.0235	.0225	1			
FSZE	.1169	.0258	-.0197	-.1385	-.1311	-.1945*	.0154	-.3184**	-.1053	-.1055	.0575	-.1426	.3957**	.2206*	.1534	.1232	-.0833	1		
D_{CRTD}	.0244	-.0033	.0137	-.0896	.0193	.0565	.1784*	.1254	.0988	.1016	-.2018	.2912**	-.3069**	-.3380**	-.0804	-.3478**	-.0524	-.1892*	1	
D_{OW}	-.0758	.0330	-.019	-.0159	-.0091	.1046	-.1138	.1066	.0926	.1726	.033	-.0694	.0422	.2067*	.0171	.0916	-.1937*	-.0263	-.0.0656	1

** correlation is significant at the 0.01 level (2-tailed)

* correlation is significant at the 0.05 level (2-tailed)